Theory-Driven Research Using SmartPLS | From Scientific Theory to International Publication

Dr. Yousef Mohammad Iriqat

THEORY-DRIVEN RESEARCH USING SmartPLS

From Scientific Theory to International Publication

SCIENTIFIC THEORY → CONCEPTUAL FRAMEWORK → RESEARCH MODEL → DATA COLLECTION → SmartPLS ANALYSIS → THEORY EVALUATION

Dr. Yousef Mohammad Iriqat

FIRST EDITION
7-2026

OPEN ACCESS EDITION

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Edition (First Edition, 7-2026)

Open Access Edition

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Open Access Edition

ISBN: (when available)

First Edition,7- 2026

https://doi.org/10.5281/zenodo.21487144

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Cite: Iriqat, Y. M. (2026). Theory-Driven Research Using SmartPLS From Scientific Theory to International Publication (Version 1). Zenodo. https://doi.org/10.5281/zenodo.21487144

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Thank you for reading this book. I hope it has contributed to your understanding of theory-driven quantitative research and the effective use of SmartPLS.

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Preface

Research is more than collecting data and applying statistical techniques. At its core, research is a process of scientific thinking that seeks to explain, understand, and contribute to knowledge. Unfortunately, many students and beginning researchers focus primarily on statistical software while paying insufficient attention to the theoretical foundations that give research its scientific value. This book was written to address that gap.

The idea for this book emerged from many years of teaching quantitative research methods, supervising students, reviewing academic manuscripts, and conducting research using Structural Equation Modeling (SEM). Throughout these experiences, I observed that many researchers were able to operate statistical software but often struggled to develop a strong theoretical framework, formulate meaningful hypotheses, interpret their findings critically, and communicate their work through scientific publication. Unlike many books that introduce SmartPLS primarily as a statistical tool, this book adopts a theory-driven approach. SmartPLS is presented as a powerful analytical instrument, but only after readers understand how research problems are identified, theories are selected, conceptual frameworks are developed, constructs are operationalized, and hypotheses are formulated. Statistical analysis is therefore viewed as one stage within a complete research lifecycle rather than as the starting point.

The book follows a logical progression from scientific theory to international publication. Readers begin by understanding the foundations of theory-driven research before learning how to build research models, develop measurement instruments, analyze data using SmartPLS, interpret empirical findings, and prepare high-quality manuscripts for publication. Throughout the book, a single running case study on Artificial Intelligence Adoption in Higher Education demonstrates how each stage builds upon the previous one, allowing readers to follow a complete research project from its initial idea to a published scientific contribution.

Although the examples focus primarily on Information Systems, Business, Education, and the Social Sciences, the principles presented in this book are applicable to a wide range of disciplines that employ quantitative research and Structural Equation Modeling. The emphasis is placed on scientific reasoning, methodological rigor, and practical application, making the book suitable for senior undergraduate students, postgraduate students, researchers, and academics seeking to strengthen their research and publishing skills.

No single book can answer every research question or replace critical thinking. Instead, this book is intended to provide a structured roadmap that helps readers make informed methodological decisions and develop research that is theoretically sound, empirically rigorous, and academically meaningful.

It is my sincere hope that this book will help readers move beyond learning how to use software toward understanding how to conduct high-quality scientific research. When theory, methodology, and statistical analysis are integrated effectively, research becomes more than an academic exercise—it becomes a meaningful contribution to scientific knowledge and professional practice.

I warmly welcome you to this journey from scientific theory to international publication and hope that the knowledge and practical guidance presented throughout this book will support your future success as a researcher.

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Statement on the Use of Artificial Intelligence

This book was developed using a collaborative writing approach that incorporated generative artificial intelligence (AI) as a writing and editorial support tool. AI assisted in drafting text, improving language clarity, organizing content, refining explanations, and generating illustrative examples and figures under the direction of the author.

The intellectual content of the book—including its concept, structure, theoretical framework, chapter organization, selection of references, methodological approach, critical review, and ***final editorial decisions***—was developed, evaluated, and approved ***by the author***. All AI-generated content was carefully reviewed, revised, and validated to ensure its accuracy, consistency, and alignment with accepted academic standards.

To the best of the author's knowledge, the information, interpretations, conclusions, and recommendations presented in this book are accurate and based on the available current scientific understanding at the time of producing the book.

.Acknowledgments

I would like to express my sincere gratitude to fellow researchers for their encouragement, valuable discussions, and continuous inspiration. I also acknowledge the many scholars whose work has contributed to the theoretical and methodological foundations of this book. It is my hope that this book contributes to the continued sharing of scientific knowledge and supports the next generation of researchers.

About the Author

Dr. Yousef Mohammad Iriqat holds a PhD in Information Technology, an MSc in Electronic and Computer Engineering, and a BSc in Electronics, Computer and Systems Engineering. His academic background combines engineering, information technology, and quantitative research, with a particular emphasis on theory-driven scientific investigation.

His research interests include Structural Equation Modeling (SEM), SmartPLS, quantitative research methods, information systems, information security, artificial intelligence, machine learning, and advanced data analytics. He has published research in international journals and conferences, reviewed scientific manuscripts, and delivered workshops on quantitative research methods, scientific writing, and academic publishing.

Through his research, teaching, and academic service, Dr. Iriqat is committed to helping students and researchers develop rigorous, theory-driven research that bridges scientific theory with practical application. This book reflects that commitment by providing a comprehensive guide to conducting, analyzing, and publishing high-quality quantitative research using SmartPLS.

How to Use This Book

This book provides a step-by-step guide to conducting theory-driven quantitative research using SmartPLS. Rather than focusing only on statistical analysis, it demonstrates how research progresses from identifying a research problem to publishing scientific findings.

The six chapters are designed to be read sequentially. Chapter 1 introduces the principles of scientific research and the role of theory. Chapter 2 explains how to develop a theory-driven

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research model. Chapter 3 focuses on constructing and validating the measurement model. Chapter 4 demonstrates data analysis using SmartPLS, while Chapter 5 explains how to interpret findings and develop meaningful scientific contributions. Chapter 6 concludes by showing how to prepare and publish research in international journals.

A running case study on Artificial Intelligence Adoption in Higher Education is integrated throughout the book to illustrate each stage of the research process. This continuous example helps readers understand how a research project evolves from an initial idea to a published scientific article.

Each chapter includes learning objectives, practical examples, figures, chapter summaries, review questions, practical exercises, and a running case study to reinforce both theoretical understanding and practical application.

Although SmartPLS is the primary analytical tool used throughout the book, the emphasis remains on scientific thinking rather than software. Readers are encouraged to apply the concepts presented in each chapter to their own research projects, developing the knowledge and skills needed to conduct rigorous, theory-driven research and communicate it effectively through scientific publication.

Book Roadmap

This book follows a logical, theory-driven research process in which each chapter builds upon the previous one. Rather than treating research as a series of independent tasks, the book demonstrates how scientific research progresses from developing a research idea to publishing a completed study. By following this sequence, readers gain both a conceptual understanding of quantitative research and the practical skills needed to conduct high-quality research using SmartPLS. The roadmap below summarizes the structure of the book.

Ch	*Focus*	*Outcome*
1	Foundations of Theory-Driven Research	Understand the role of scientific theory and research thinking.
2	Building a Theory-Driven Research Model	Develop the conceptual framework and research hypotheses.
3	From Theory to Measurement	Design and validate the measurement model and research instrument.
4	SmartPLS Data Analysis	Evaluate the measurement and structural models using SmartPLS.
5	Interpreting and Discussing Results	Transform statistical findings into theoretical and practical contributions.
6	Scientific Writing and Publication	Prepare, submit, and publish research in international journals.

Together, these six chapters present a complete research lifecycle, enabling readers to move confidently from a research idea to a published scientific contribution.

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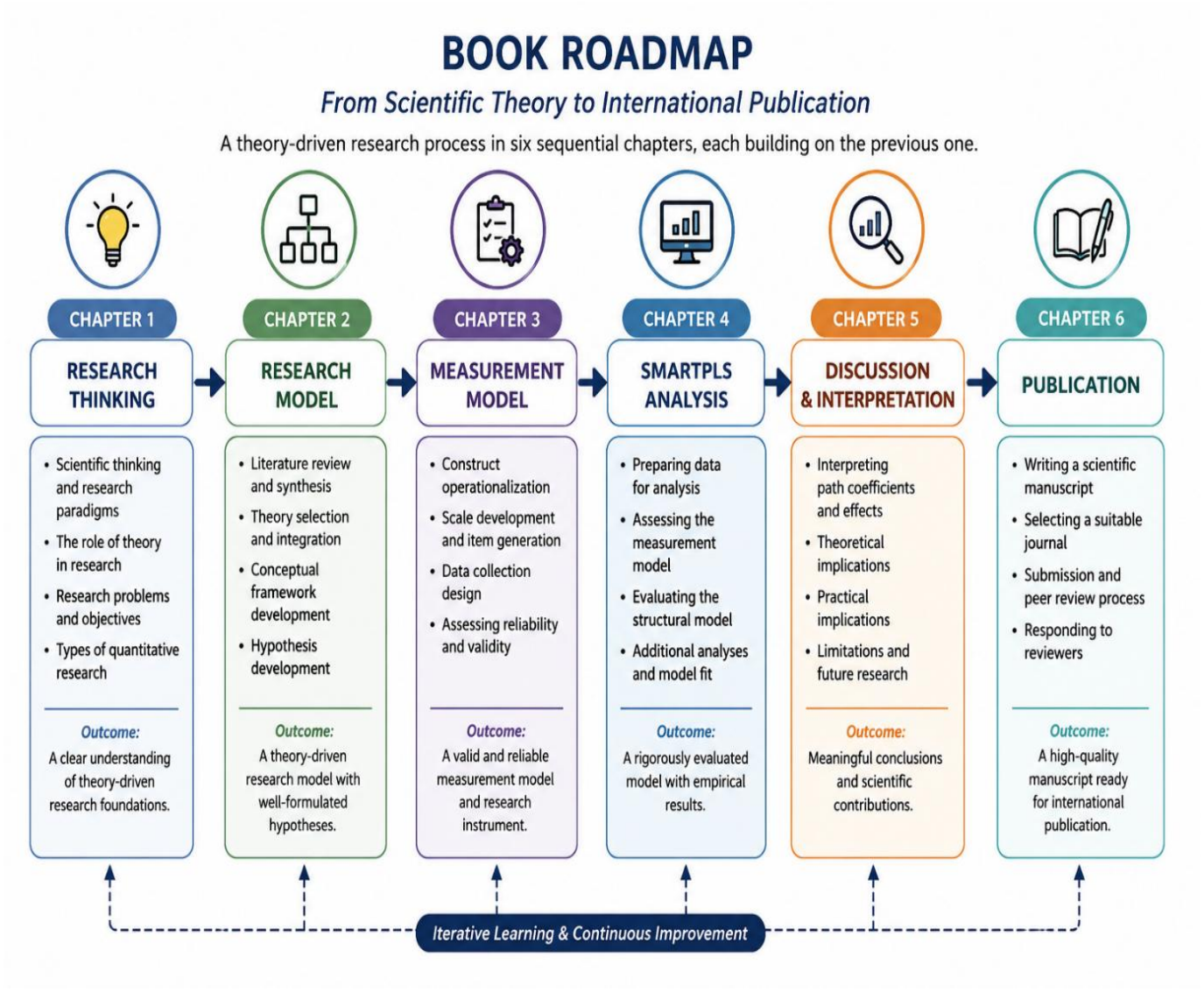
BOOK ROADMAP
From Scientific Theory to International Publication
A theory-driven research process in six sequential chapters, each building on the previous one.
CHAPTER 1
RESEARCH THINKING
• Scientific thinking and research paradigms
• The role of theory in research
• Research problems and objectives
• Types of quantitative research
Outcome:
A clear understanding of theory-driven research foundations.
CHAPTER 2
RESEARCH MODEL
• Literature review and synthesis
• Theory selection and integration
• Conceptual framework development
• Hypothesis development
Outcome:
A theory-driven research model with well-formulated hypotheses.
CHAPTER 3
MEASUREMENT MODEL
• Construct operationalization
• Scale development and item generation
• Data collection design
• Assessing reliability and validity
Outcome:
A valid and reliable measurement model and research instrument.
CHAPTER 4
SMARTPLS ANALYSIS
• Preparing data for analysis
• Assessing the measurement model
• Evaluating the structural model
• Additional analyses and model fit
Outcome:
A rigorously evaluated model with empirical results.
CHAPTER 5
DISCUSSION & INTERPRETATION
• Interpreting path coefficients and effects
• Theoretical implications
• Practical implications
• Limitations and future research
Outcome:
Meaningful conclusions and scientific contributions.
CHAPTER 6
PUBLICATION
• Writing a scientific manuscript
• Selecting a suitable journal
• Submission and peer review process
• Responding to reviewers
Outcome:
A high-quality manuscript ready for international publication.
Iterative Learning & Continuous Improvement

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Introduction

The Philosophy of This Book

Scientific research is the systematic pursuit of knowledge through the formulation of meaningful questions, the development of theoretically grounded explanations, and the rigorous evaluation of evidence. Regardless of discipline, high-quality research does not begin with statistical software or sophisticated analytical techniques. Instead, it begins with an intellectual curiosity about a phenomenon that requires explanation. From this curiosity emerges a research problem, which is subsequently investigated through the application of scientific theories, appropriate research methodologies, and empirical analysis. Statistical techniques therefore represent only one component of a much broader research process.

During the past two decades, the increasing accessibility of statistical software has transformed quantitative research. Programs such as SPSS, SmartPLS, AMOS, and R have enabled researchers to perform complex analyses with unprecedented ease. In particular, Partial Least Squares Structural Equation Modeling (PLS-SEM), implemented through SmartPLS, has become one of the most widely used analytical approaches for exploring, explaining, and predicting complex structural relationships in disciplines including Information Systems, Business, Marketing, Education, Healthcare, Supply Chain Management, Tourism, and the Social Sciences (Hair et al., 2022; Sarstedt et al., 2022). Its ability to analyze complex models, accommodate smaller sample sizes, and support predictive research has contributed significantly to its widespread adoption.

Despite these methodological advances, an important challenge remains. Many postgraduate students and early-career researchers become proficient in operating statistical software while struggling to develop theoretically meaningful research. In many cases, research projects begin with data collection, followed by statistical analysis, and only afterward attempting to identify a theory capable of explaining the observed results. Such an approach reverses the logic of scientific inquiry and often leads to weak theoretical justification, limited scholarly contribution, and unfavorable reviewer evaluations. Statistical significance alone cannot compensate for inadequate theoretical development. *This observation provides the central motivation for writing this book.*

Unlike many existing SmartPLS textbooks, which primarily emphasize software procedures and statistical thresholds, this book adopts a theory-driven perspective. It argues that every methodological decision—including research design, construct development, measurement specification, model evaluation, and interpretation of findings—should originate from a clearly articulated theoretical foundation. SmartPLS is therefore presented not as the objective of research, but as one analytical instrument used to evaluate theoretical propositions.

The philosophy underlying this book may be summarized in a single principle:

Theory gives research direction; evidence gives research credibility; together they create scientific contribution.

This principle reflects the belief that meaningful research emerges from the integration of sound theoretical reasoning and rigorous empirical evaluation. Neither component is sufficient independently. Theory without empirical evidence remains speculative, whereas statistical analysis without theoretical justification contributes little to cumulative scientific knowledge.

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Why Another Book on SmartPLS?

The growing popularity of PLS-SEM has resulted in numerous excellent textbooks that explain its statistical foundations and practical implementation. Foundational contributions by Hair, Henseler, Ringle, Sarstedt, and their colleagues have significantly advanced researchers' understanding of variance-based structural equation modeling and established methodological standards for conducting and reporting PLS-SEM studies. *This book does not seek to replace those contributions. Instead, it addresses a different educational need*.

Many researchers encounter difficulties not because they cannot operate SmartPLS, but because they struggle with the earlier stages of the research process. Questions such as **"***Which theory should I select?"***,** *"How do I develop a conceptual framework?"***,** *"How are hypotheses derived from theory?"***,** *and "Should my construct be reflective or formative?"* frequently arise long before SmartPLS is opened. These decisions ultimately determine the quality of the empirical analysis and the significance of the resulting scientific contribution.

Accordingly, the emphasis of this book extends beyond statistical procedures to encompass the complete research journey—from identifying a research problem to publishing findings in an international peer-reviewed journal.

The Theory-Driven Research Journey

This book presents research as an integrated process consisting of interconnected stages rather than isolated methodological tasks. Every research project begins with the identification of an important phenomenon requiring explanation. Through critical engagement with the literature, researchers identify an appropriate theoretical perspective capable of explaining that phenomenon. For example, a researcher investigating technology adoption may employ the Theory of Planned Behavior (Ajzen, 1991) or another established theoretical perspective to explain behavioral intentions before designing hypotheses and collecting empirical data. The selected theory informs the development of a conceptual framework, the formulation of hypotheses, and the operationalization of constructs. These theoretical decisions subsequently guide questionnaire design, sampling, data collection, and empirical analysis using SmartPLS. Finally, statistical findings are interpreted in light of the underlying theory and communicated through scholarly publication.

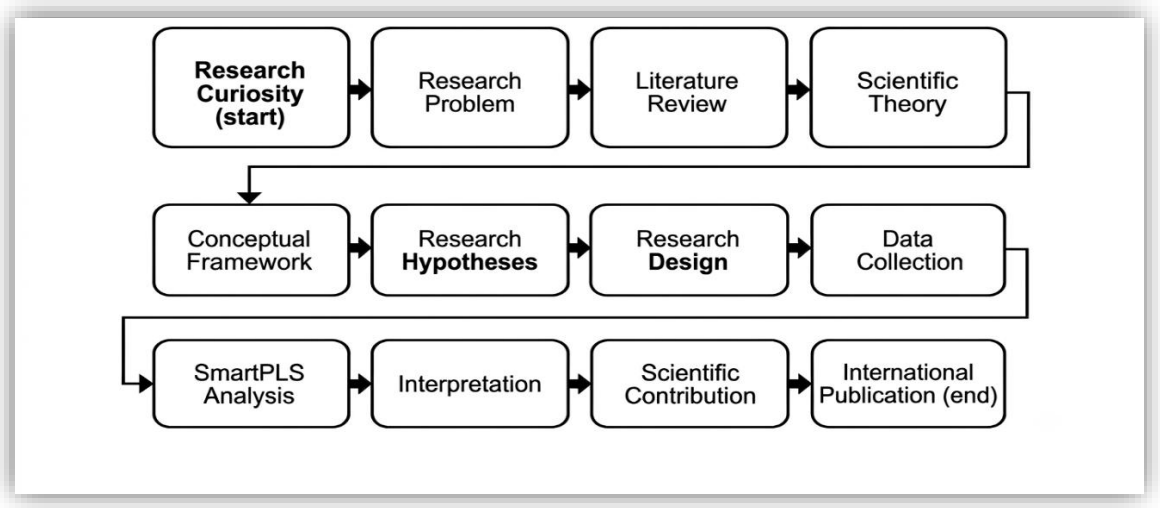

Figure 1.1: The theory-driven research journey adopted throughout this book

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Throughout the book, emphasis is placed on understanding *why* methodological decisions are made before explaining *how* they are implemented. This distinction reflects the conviction that successful researchers must develop conceptual understanding before mastering analytical techniques.

Organization of the Book

The book is organized into six chapters that mirror the progression of a typical quantitative research project.

Chapter 1 introduces the foundations of scientific thinking by examining the nature of theory, theory development, and the role of scientific reasoning in quantitative research.

Chapter 2 demonstrates how researchers transform a research problem into a theory-driven conceptual model through literature review, theory selection, construct identification, and hypothesis development.

Chapter 3 focuses on research design, including questionnaire development, measurement specification, reflective and formative constructs, sampling strategies, and data preparation.

Chapter 4 introduces PLS-SEM and SmartPLS as tools for evaluating theoretical models. The chapter explains the assessment of measurement and structural models while emphasizing the interpretation of analytical results rather than software mechanics.

Chapter 5 examines how empirical findings are transformed into theoretical and practical contributions. Readers learn how to interpret statistical evidence, evaluate hypotheses, conduct mediation and moderation analyses, and discuss research implications.

Finally, Chapter 6 guides readers through the process of preparing and publishing a high-quality research manuscript. Particular attention is devoted to reporting standards, responding to reviewers, ethical considerations surrounding artificial intelligence, and common reasons for manuscript rejection.

How to Use This Book

Although each chapter may be read independently, the greatest educational benefit is achieved by following the sequence presented. Each chapter builds upon concepts introduced previously and contributes to a continuous research project that accompanies the reader throughout the book. By progressing systematically from theory development to publication, readers will gain not only technical competence in SmartPLS but also a deeper understanding of how rigorous quantitative research is conceived, designed, evaluated, and communicated.

The intended audience includes Master's students, doctoral candidates, academic researchers, and practitioners seeking to strengthen their understanding of theory-driven quantitative research. Readers are expected to possess a basic understanding of research methods; however, no prior experience with SmartPLS is assumed.

Ultimately, the objective of this book is not merely to teach researchers how to analyze data. Its broader purpose is to cultivate the intellectual habits required to conduct theory-driven research that contributes meaningfully to scientific knowledge and meets the expectations of the international research community.

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Chapter 1

Thinking Like a Researcher

Chapter Purpose: This chapter introduces the intellectual foundations of theory-driven research. Before a researcher can use SmartPLS effectively, they must understand how scientific research begins, why theory matters, and how research questions, frameworks, models, and hypotheses are logically connected. The chapter therefore establishes the mindset required for conducting rigorous quantitative research.

Chapter Learning Objectives

After completing this chapter, readers should be able to:

1. Explain why scientific research begins with meaningful research problems and questions.
2. Define scientific theory and describe its role in guiding quantitative research.
3. Distinguish between scientific theory, conceptual frameworks, research models, and hypotheses.
4. Differentiate between theory building and theory testing and explain their contributions to scientific knowledge.
5. Compare deductive, inductive, and abductive reasoning and identify their applications in research.
6. Apply the concepts presented in this chapter to the accompanying running case study to develop a theory-driven foundation for quantitative research using SmartPLS.

1.1 Why Research Begins with Questions

Scientific research begins with questions. Before researchers select a theory, design a questionnaire, collect data, or open SmartPLS, they must first identify a phenomenon that requires explanation. A research project without a clear question lacks direction. It may generate data, tables, and statistical results, but it is unlikely to produce meaningful scientific knowledge.

A research question gives purpose to the entire study. It defines what the researcher wants to understand, explain, predict, or evaluate. It also determines which literature should be reviewed, which theory should be selected, which constructs should be measured, and which analytical technique is appropriate. In this sense, the quality of a research project depends heavily on the quality of the question that initiates it.

In postgraduate research, many students begin too late in the research process. They start by asking, “Which software should I use?” or “How do I run SmartPLS?” These are important technical questions, but they are not the starting point of scientific inquiry. The more fundamental question is: “What phenomenon am I trying to explain?” Without answering this question, statistical analysis becomes a technical exercise rather than a scientific investigation.

For example, a researcher interested in artificial intelligence adoption in higher education may begin with a broad curiosity: Why do some instructors adopt AI tools while others avoid them?

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This curiosity can then be refined into a research problem: despite the availability of AI technologies, their adoption among university instructors remains uneven. From this problem, the researcher may formulate a research question such as: What factors influence university instructors' adoption of AI tools for teaching and learning?

This progression from curiosity to research problem to research question is essential. Curiosity is broad and often informal. A research problem is more focused and identifies a gap, difficulty, contradiction, or unresolved issue in the literature or practice. A research question transforms that problem into an investigable inquiry.

Good research questions are not merely descriptive. They should open the possibility for explanation. Descriptive questions ask what is happening. Explanatory questions ask why it is happening. Predictive questions ask what is likely to happen under certain conditions. Theory-driven research normally requires explanatory and predictive questions because theory is concerned with relationships, mechanisms, and causes.

For instance, the question "How many instructors use AI tools?" is descriptive. It may be useful for reporting adoption levels, but it does not provide a strong foundation for theory testing. By contrast, the question "How do trust, digital competence, and institutional support influence AI adoption among university instructors?" invites theoretical explanation and empirical testing. This second question can lead naturally to constructs, hypotheses, and a structural model suitable for SmartPLS analysis.

Research questions also protect researchers from methodological confusion. When the question is unclear, researchers may include too many variables, select inappropriate theories, design weak questionnaires, or misuse statistical methods. A clear question helps the researcher make disciplined choices. It determines what belongs in the study and what should be excluded.

This is especially important in PLS-SEM research. SmartPLS can estimate complex models with many constructs and indicators, but complexity does not guarantee quality. A large model without a clear research question may appear sophisticated while remaining theoretically weak. The researcher's task is not to build the biggest model possible, but to build the most theoretically meaningful model required to answer the research question.

The relationship between research questions and theory is therefore central. A strong research question should lead the researcher toward a suitable theoretical explanation. Theories such as the Technology Acceptance Model, the Theory of Planned Behavior, Diffusion of Innovations, and the Unified Theory of Acceptance and Use of Technology have been widely used because they help explain technology-related behavior and adoption (Ajzen, 1991; Davis, 1989; Rogers, 2003; Venkatesh et al., 2003). However, the theory should be selected because it explains the research problem, not simply because it is popular.

A useful test for beginning researchers is to ask whether their research question can be connected to a theoretical explanation. If the answer is no, the question may need further refinement. A research question that cannot be linked to theory may still be valuable for descriptive or exploratory work, but it may not be suitable for theory-driven PLS-SEM research.

In this book, research questions are treated as the first serious intellectual decision in the research process. They are not administrative statements included only to satisfy thesis or journal requirements. They are the foundation upon which theory selection, conceptual modeling, measurement, analysis, interpretation, and publication depend.

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The guiding principle is simple: *A researcher who asks a weak question will struggle to build a strong model.*

Therefore, before learning how to assess reliability, validity, path coefficients, mediation, moderation, or predictive relevance, the reader must first learn how to think like a researcher. Thinking like a researcher begins with asking questions that are theoretically meaningful, empirically testable, and capable of contributing to scientific knowledge.

Note: Do not begin with the software. Begin with the phenomenon. SmartPLS can test a model, but it cannot create a meaningful research question for you.

1.2 What Is Scientific Theory?

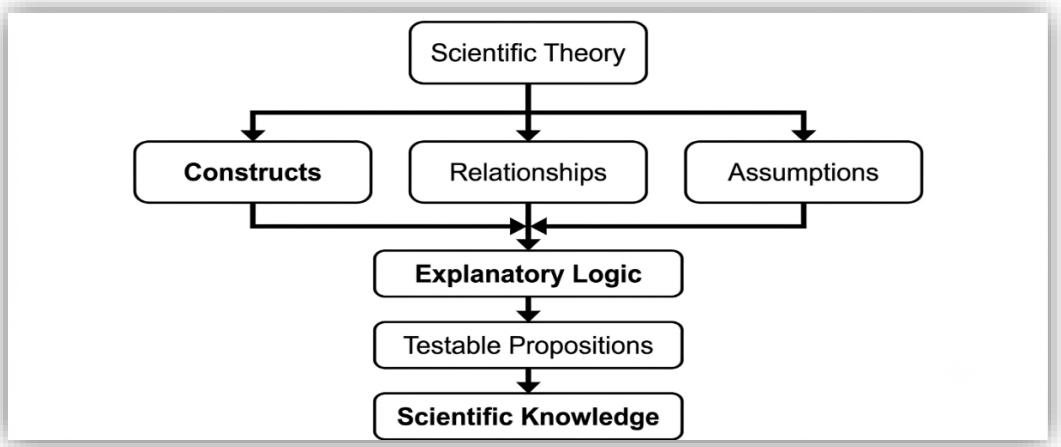

Figure 1.2. The Building Blocks of a Scientific Theory

A scientific theory is an organized system of constructs, relationships, assumptions, and explanatory logic that generates testable propositions and contributes to scientific knowledge.

1.2.1 Understanding the Meaning of Theory

Few concepts in research methodology are used as frequently—and misunderstood as often—as the word *theory*. In everyday conversation, people commonly use the term to describe a guess, opinion, intuition, or personal belief. Expressions such as *"I have a theory about why students prefer online learning"* or *"My theory is that social media reduces attention spans"* illustrate this informal usage. In scientific research, however, the meaning of theory is fundamentally different.

A scientific theory is not speculation. It is not an opinion waiting to be confirmed, nor is it an idea invented without evidence. Rather, a scientific theory is a logically organized system of concepts and propositions developed to explain, predict, and understand observable phenomena. Scientific theories emerge through continuous observation, logical reasoning, empirical investigation, and scholarly refinement. They provide researchers with explanatory frameworks that help answer one of the most important questions in science:

Why does this phenomenon occur?

This distinction is particularly important for postgraduate researchers. Many students assume that collecting data and obtaining statistically significant results automatically produces scientific knowledge. In reality, statistical evidence acquires meaning only when interpreted

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within an appropriate theoretical context. Theory transforms isolated empirical findings into coherent scientific explanations.

For example, suppose a researcher discovers that institutional support has a positive and statistically significant effect on instructors' adoption of artificial intelligence technologies. The statistical analysis demonstrates that a relationship exists, but it does not explain *why* institutional support influences adoption. Theory provides that explanation by identifying the underlying mechanisms through which organizational support shapes individual behavior.

Therefore, theory is not an optional component of research. It is the intellectual foundation upon which meaningful scientific inquiry is built.

1.2.2 Definitions of Scientific Theory

Throughout the history of scientific inquiry, scholars have proposed numerous definitions of theory. Although these definitions differ in emphasis, they consistently describe theory as a systematic explanation of relationships among concepts.

Kerlinger and Lee (2000) defined theory as: *"A set of interrelated constructs (concepts), definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena"* (p. 11).

This definition remains one of the most influential in behavioral and social science research because it emphasizes four essential characteristics. First, theories consist of constructs and concepts. Second, they specify relationships among those constructs. Third, they explain observed phenomena. Finally, they generate predictions that can be tested empirically.

Similarly, Bacharach (1989) described theory as a statement of relationships among concepts operating within clearly defined assumptions and boundary conditions. According to this perspective, theories do not merely identify relationships; they also specify the conditions under which those relationships are expected to occur.

Dubin (1978) argued that a theory should contain clearly defined units, interactions among those units, and explicit boundaries that determine the scope of its applicability. Without such boundaries, theoretical explanations become too broad to be scientifically useful.

Sutton and Staw (1995) further clarified the nature of theory by explaining what theory is not. According to these authors, references, variables, hypotheses, diagrams, and empirical data do not constitute theory independently. These elements may support theoretical development, but theory requires explanatory reasoning that connects concepts into a coherent system.

Taken together, these definitions demonstrate that theory is far more than a collection of variables or statistical relationships. It is a structured explanation that organizes knowledge and enables researchers to understand, predict, and evaluate complex phenomena.

1.2.3 Components of a Scientific Theory

Although theories vary across disciplines, most scientific theories contain several common components.

Constructs **:** Constructs are abstract concepts that cannot be observed directly but can be measured indirectly through indicators. Examples include trust, satisfaction, organizational

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commitment, perceived usefulness, teaching innovation, and digital competence. In quantitative research, constructs become the central variables within conceptual models and are operationalized through measurement instruments such as questionnaires.

*Relationships***:** Theories specify how constructs are expected to relate to one another. For example, the Technology Acceptance Model proposes that perceived usefulness positively influences behavioral intention to use technology (Davis, 1989). The relationship is not arbitrary; it is supported by theoretical reasoning explaining why individuals adopt technologies they perceive as beneficial.

*Assumptions***:** Every theory is built upon assumptions concerning human behavior, organizational processes, or environmental conditions. These assumptions establish the context within which theoretical explanations remain valid.

*Boundary Conditions***:** No theory explains every phenomenon under all circumstances. oundary conditions define the situations in which theoretical predictions are expected to apply. A theory developed within higher education, for example, may require modification before being applied in healthcare or manufacturing contexts.

*Propositions***:** Theoretical propositions express expected relationships among constructs. These propositions later become formal research hypotheses that can be evaluated empirically through statistical analysis.

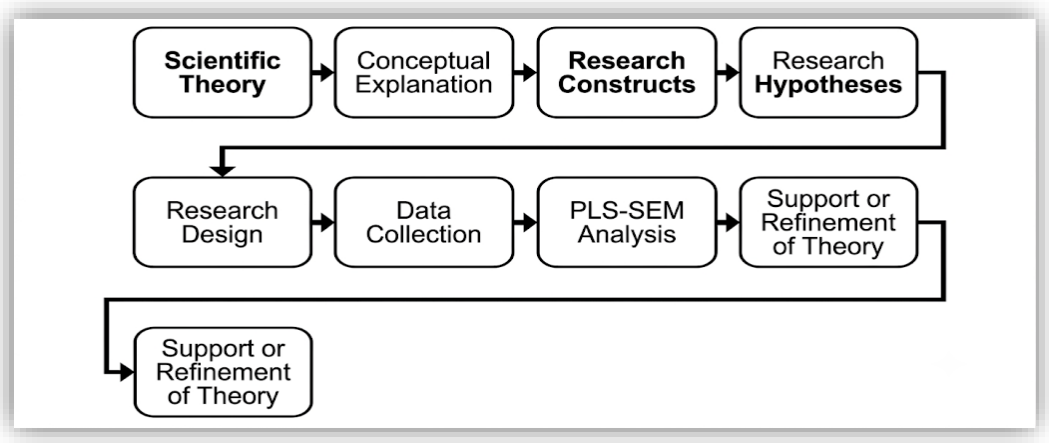

Figure 1.3: From Theory to Empirical Testing

Scientific theories guide every stage of quantitative research, from conceptual explanation to empirical testing and theoretical refinement.

1.2.4 Characteristics of Strong Scientific Theories

Not all theories contribute equally to scientific knowledge. Strong theories possess several characteristics that distinguish them from weak or incomplete explanations. A strong theory demonstrates *clarity* by defining its concepts precisely and avoiding ambiguity. Researchers should be able to understand exactly what each construct represents and how it relates to other constructs. A strong theory also possesses *logical consistency*. Its assumptions, concepts, and propositions should be internally coherent and free from contradiction.

Another essential characteristic is *explanatory power*. Effective theories explain why relationships exist rather than merely describing observable patterns.

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Scientific theories should also exhibit *predictive capability*. They should enable researchers to anticipate future observations under specified conditions.

Equally important is *testability*. Scientific theories generate propositions that can be examined empirically. If theoretical claims cannot be evaluated through evidence, their scientific value becomes limited. Finally, strong theories acknowledge their own *boundary conditions*. They recognize that explanations may not apply universally and identify the contexts in which predictions are expected to remain valid.

1.2.5 Why Theory Matters in SmartPLS Research

Within the context of SmartPLS, theory performs a critical function. PLS-SEM estimates relationships among constructs, but it does not determine whether those relationships should exist. Software calculates path coefficients, reliability indices, validity measures, and predictive statistics. Theory explains why these relationships deserve investigation. Consequently, SmartPLS should never be viewed as a tool for discovering theory. Instead, it is a tool for evaluating theoretically justified models.

Researchers who begin by constructing statistical models without theoretical justification often produce analyses that are technically correct but scientifically weak. Conversely, researchers who begin with sound theoretical reasoning are able to develop coherent conceptual models whose empirical evaluation contributes to cumulative scientific knowledge.

Note: A theory should never be selected because it is the most frequently cited. A theory should be selected because it provides the most convincing explanation for the research problem under investigation.

Key Takeaway: Scientific theories provide the explanatory foundation of quantitative research. They organize concepts, explain relationships, generate testable propositions, and guide every subsequent stage of the research process. SmartPLS evaluates theoretical models, but theory determines what should be evaluated and why.

1.3 Why Theory Matters

Theory occupies the central position in the research process. Every methodological decision, from research design to interpretation of findings, should be guided by theoretical reasoning.

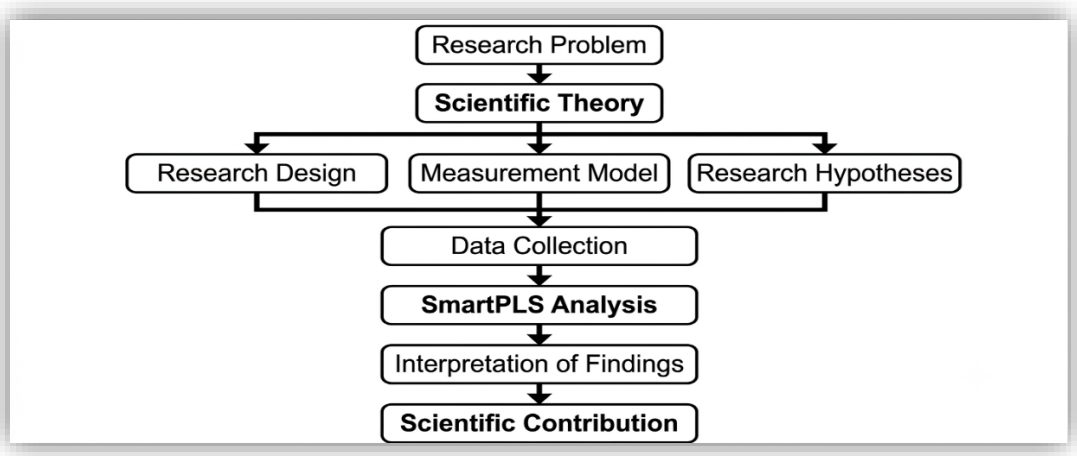

Figure 1.4: The Central Role of Theory in Scientific Research

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1.3.1 Theory as the Foundation of Scientific Inquiry

Scientific research is not merely the collection of data or the application of statistical techniques. Its primary objective is to generate knowledge that explains, predicts, or improves our understanding of observable phenomena. Theory provides the intellectual foundation that makes this objective possible.

Every scientific discipline relies on theories to organize knowledge and explain relationships among concepts. Without theory, research becomes a collection of disconnected observations that are difficult to interpret, compare, or generalize. Theory transforms isolated findings into coherent explanations that contribute to cumulative scientific knowledge.

For example, suppose two researchers independently observe that organizational support influences employees' willingness to adopt new technologies. Without a theoretical framework, both studies simply report similar statistical relationships. However, when interpreted through an appropriate theory, these findings contribute to a broader understanding of technology adoption and can be compared with previous and future studies.

Theory therefore provides continuity in scientific research. It enables individual studies to become part of a larger body of knowledge rather than remaining isolated investigations.

1.3.2 Theory Explains Why Relationships Exist

One of the most important functions of theory is explanation. Statistical analysis can identify whether a relationship exists between two variables, but it cannot explain why that relationship exists. For example, SmartPLS may indicate that institutional support has a statistically significant positive effect on teaching innovation. The software reports the path coefficient, significance level, and effect size, but it does not explain the underlying mechanism responsible for the relationship.

Theory provides that explanation. It identifies the conceptual processes through which one construct influences another. Consequently, theory answers questions that statistical analysis alone cannot answer. Researchers should therefore distinguish between two different questions:

- *Statistical question***:** Is there a significant relationship?
- *Scientific question***:** Why does this relationship exist?

Scientific contribution emerges primarily from answering the second question.

1.3.3 Theory Supports Prediction

Beyond explanation, theories enable researchers to make predictions. Scientific theories propose that under certain conditions, particular relationships should occur. These predictions can then be evaluated through empirical research.

For example, the Technology Acceptance Model predicts that individuals who perceive a technology as useful are more likely to adopt it (Davis, 1989). Similarly, the Theory of Planned Behavior predicts that attitudes, subjective norms, and perceived behavioral control influence behavioral intentions (Ajzen, 1991).

Prediction is particularly important in modern PLS-SEM research. While covariance-based structural equation modeling has traditionally emphasized theory confirmation, PLS-SEM increasingly supports both explanatory and predictive research (Hair et al., 2022; Shmueli et al., 2019). Prediction, however, should never be confused with data mining. Predictions must

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originate from theoretical reasoning rather than from searching for statistically significant relationships without conceptual justification.

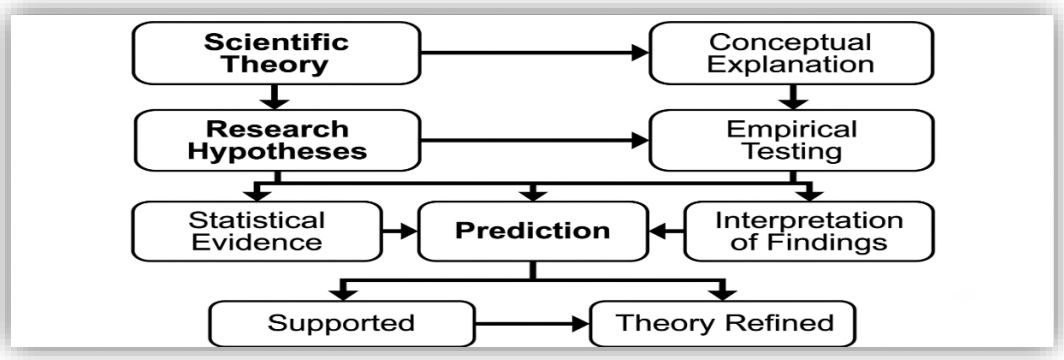

Figure 1.5: From Theory to Prediction

Theory generates predictions that are evaluated through empirical research. Research findings either support existing theoretical explanations or contribute to their refinement.

1.3.4 Theory Guides the Entire Research Process

Theory influences every major decision made during a research project. The research question should emerge from a phenomenon that theory can explain. The literature review identifies existing theoretical perspectives relevant to the problem under investigation. The conceptual framework organizes constructs according to theoretical logic. Hypotheses represent theoretical propositions translated into testable statements. Measurement instruments operationalize theoretical constructs, and statistical analysis evaluates whether empirical evidence supports theoretical expectations.

Consequently, theory functions as the connecting thread linking every stage of the research process. When theory is absent, researchers often experience several common difficulties. They may struggle to justify construct selection, formulate meaningful hypotheses, interpret empirical findings, or explain the significance of their results. These weaknesses frequently appear in reviewers' comments during the journal publication process. Strong theoretical foundations therefore improve both the scientific quality and the publishability of research.

1.3.5 Theory and Scientific Contribution

The ultimate purpose of scientific research is not simply to obtain statistically significant results. Rather, it is to contribute new knowledge. Scientific contribution may take several forms. Research may confirm an existing theory within a new context, extend a theory by introducing additional constructs, identify important boundary conditions, compare competing theories, or propose an entirely new theoretical explanation.

Regardless of the type of contribution, theory remains central. A study reporting statistically significant path coefficients without discussing their theoretical implications contributes relatively little to scientific knowledge. By contrast, a study that explains how its findings support, refine, or challenge an existing theory advances scholarly understanding and is more likely to be recognized as a meaningful contribution. *Researchers should therefore ask not only whether their hypotheses were supported but also what their findings imply for theory*.

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1.3.6 Why Theory Matters in SmartPLS Research

One of the misconceptions among beginning researchers is that sophisticated statistical software can compensate for weak theoretical foundations. *This is incorrect*.

SmartPLS is a powerful analytical tool capable of estimating complex structural relationships. It evaluates measurement quality, estimates path coefficients, assesses predictive relevance, and examines mediation and moderation effects. However, SmartPLS does not determine which constructs belong in the model, why they should be related, or whether the proposed hypotheses are theoretically meaningful. Those decisions belong to the researcher. Software evaluates evidence. Theory provides explanation.

For this reason, the quality of a SmartPLS analysis depends far more on the quality of the theoretical model than on the complexity of the statistical procedure. An elegant statistical model built upon weak theoretical assumptions rarely produces meaningful scientific contributions. The philosophy adopted throughout this book may therefore be summarized as follows:

Theory determines what should be tested. SmartPLS determines whether empirical evidence supports the proposed theoretical relationships. "Does theory justify this model?"

Theory is the foundation of scientific research because it explains phenomena, guides methodological decisions, generates testable predictions, and transforms statistical findings into scientific knowledge. SmartPLS provides empirical evidence, but theory gives that evidence meaning.

1.4 Theory versus Framework versus Model

Scientific theories provide the conceptual foundation of research. Conceptual frameworks organize theoretical ideas within the context of a specific study, while research models operationalize those ideas into measurable relationships suitable for empirical testing.

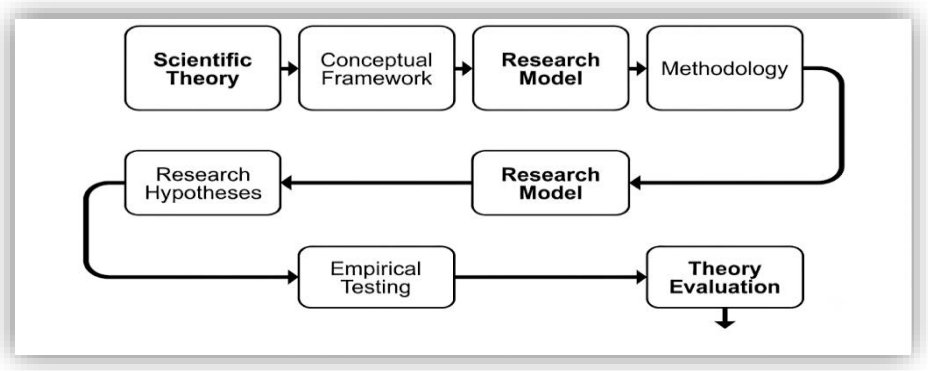

Figure 1.6: The Relationship Between Theory, Framework, and Model

1.4.1 Why Researchers Confuse These Concepts

Among postgraduate students, few methodological concepts generate more confusion than the distinction between theory, conceptual framework, and research model. These terms are frequently used interchangeably in research proposals, theses, dissertations, and journal articles, despite representing fundamentally different concepts.

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A common example illustrates this confusion. A student develops a diagram showing five constructs connected by arrows and refers to it as "the theoretical framework." Another student describes the Technology Acceptance Model (TAM) as the conceptual framework of the study. A third student claims that the hypotheses themselves represent the theory. Although these expressions are widespread, they are methodologically inaccurate.

Understanding the differences among these concepts is essential because each serves a distinct role within scientific research. Confusing them often leads to weak theoretical justification, poorly developed hypotheses, and conceptual inconsistency throughout the study.

1.4.2 What Is a Scientific Theory?

A *scientific theory* is a coherent system of concepts and propositions developed to explain and predict relationships among phenomena. It provides the intellectual explanation for why certain relationships are expected to exist. Theories answer questions such as:

- Why do individuals adopt new technologies?
- Why do employees comply with information security policies?
- Why does organizational support influence innovation?

Scientific theories are general in nature. They are not developed for one particular study but are intended to explain classes of phenomena across multiple contexts.

Examples include:

- Technology Acceptance Model (TAM)
- Theory of Planned Behavior (TPB)
- Unified Theory of Acceptance and Use of Technology (UTAUT)
- Diffusion of Innovations (DOI)
- Resource-Based View (RBV)

Researchers normally adopt, compare, extend, or integrate existing theories rather than developing entirely new ones.

1.4.3 What Is a Conceptual Framework?

A conceptual framework is the researcher's interpretation of how one or more theories apply to a specific research problem. Unlike a scientific theory, which is broad and general, a conceptual framework is study-specific. It identifies the constructs relevant to the research problem and explains why these constructs are expected to influence one another.

A conceptual framework therefore serves as the bridge between theory and empirical investigation. For example, a researcher investigating artificial intelligence adoption among university instructors may select UTAUT as the primary theoretical foundation. However, after reviewing the literature, the researcher may decide to incorporate additional constructs such as trust in AI and digital competence because these variables are particularly relevant to the educational context.

The resulting conceptual framework reflects the researcher's theoretical reasoning regarding the phenomenon under investigation. Consequently, two studies may rely on the same theory while developing different conceptual frameworks because they address different research problems.

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1.4.4 What Is a Research Model?

A *research model* is the graphical representation of the conceptual framework. It translates theoretical relationships into a structure that can be tested empirically. The research model specifies:

- Independent variables
- Dependent variables
- Mediating variables
- Moderating variables
- Direction of relationships

In quantitative research, particularly PLS-SEM, the research model becomes the blueprint for empirical analysis.Unlike the conceptual framework, which emphasizes theoretical explanation, the research model emphasizes operationalization. It identifies precisely which relationships will be evaluated statistically. For example, a research model may propose that:

- Digital Competence → AI Adoption
- Trust in AI → AI Adoption
- Institutional Support → AI Adoption
- AI Adoption → Teaching Innovation

These relationships are then translated into research hypotheses and tested using SmartPLS.

1.4.5 From Theory to Empirical Testing

The relationship among theory, conceptual framework, and research model is sequential. Researchers begin by selecting a theory capable of explaining the research problem. They then develop a conceptual framework that adapts the theory to the specific context of the study.

Finally, they construct a research model that operationalizes the conceptual framework into measurable relationships suitable for empirical investigation. This sequence ensures that every hypothesis originates from theoretical reasoning rather than statistical convenience. Skipping any of these stages weakens the scientific integrity of the research. Theory-driven research progresses logically from theoretical explanation to empirical evaluation. Each stage builds upon the preceding stage.

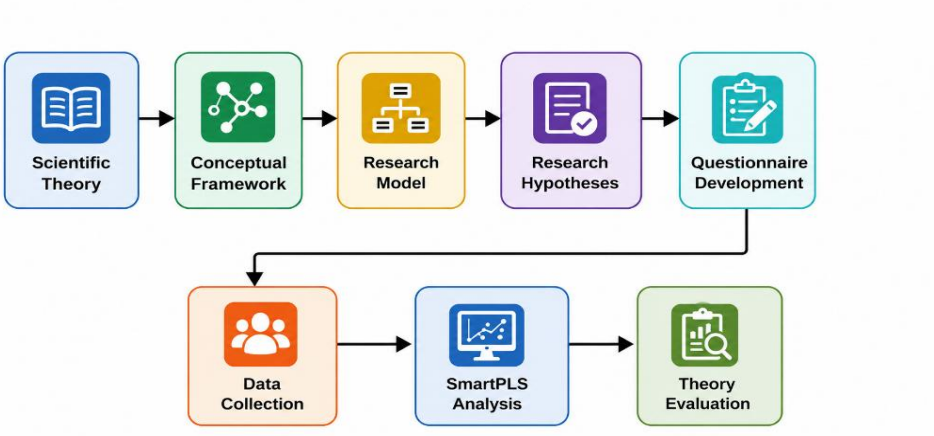

Figure 1.7: The Theory-Driven Research Process

Key Takeaway: Scientific theories provide general explanations of phenomena. Conceptual frameworks adapt those explanations to a specific research problem by identifying the relevant constructs and their expected relationships. Research models transform conceptual frameworks into empirically testable structures suitable for statistical analysis using SmartPLS.

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Understanding the distinction among these concepts is fundamental to developing rigorous theory-driven research.

Note: Remember this sequence: *Theory explains. The conceptual framework organizes. The research model tests.* If these three roles remain clear throughout your study, the logic of your research will also remain clear.

1.5 Theory Building versus Theory Testing

1.5.1 Understanding the Difference

Theory building and theory testing are two central activities in scientific research. Although they are closely connected, they serve different purposes. Theory building refers to the process of developing new theoretical explanations or extending existing ones. It is concerned with generating ideas, identifying patterns, proposing relationships, and explaining why a phenomenon occurs. Theory testing, by contrast, refers to the process of evaluating whether empirical evidence supports a theory, conceptual framework, or set of hypotheses. It is concerned with examining whether theoretically expected relationships are supported by data.

The distinction may be summarized simply: Theory building asks: What explanation can account for this phenomenon? Theory testing asks: Does the evidence support this explanation?

Both are necessary for scientific progress. Theory building without testing may remain speculative. Theory testing without theoretical development may become mechanical and contribute little beyond confirming what is already known.

1.5.2 What Is Theory Building?

Theory building begins when researchers attempt to explain a phenomenon that is insufficiently understood. This may occur when existing theories are inadequate, when a new context emerges, or when empirical observations suggest that current explanations require refinement.

For example, the rapid adoption of artificial intelligence tools in higher education creates new research questions. Traditional technology adoption theories may explain some aspects of AI use, such as perceived usefulness or ease of use. However, AI also raises issues of trust, academic integrity, algorithmic transparency, ethical concern, and institutional readiness. These issues may require researchers to extend existing theories or build more context-sensitive explanations. Theory building may take several forms.

First, researchers may develop a new explanation for a phenomenon that has not been adequately studied.

Second, they may extend an existing theory by adding new constructs, relationships, or boundary conditions.

Third, they may integrate multiple theories to provide a more comprehensive explanation.

Fourth, they may refine an existing theory by clarifying concepts, improving definitions, or specifying when theoretical relationships are likely to occur.

Theory building is therefore not limited to inventing entirely new theories. In fact, most postgraduate and early-career researchers are more likely to extend, adapt, or refine existing

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theories than to create completely new ones. This point is important. Many students mistakenly believe that theoretical contribution requires inventing a new theory. In most cases, a stronger and more realistic contribution is achieved by showing how an existing theory can be improved, applied to a new context, or integrated with another theoretical perspective.

1.5.3 What Is Theory Testing?

Theory testing begins with an existing theoretical explanation. The researcher derives hypotheses from the theory, collects empirical data, and evaluates whether the evidence supports the expected relationships. In quantitative research, theory testing usually follows a deductive logic. The researcher begins with a theory, develops hypotheses, designs measures, collects data, and applies statistical analysis. In SmartPLS research, this often involves testing relationships among latent constructs using PLS-SEM.

For example, if a researcher uses the Technology Acceptance Model to study AI adoption, the theory may lead to the hypothesis that perceived usefulness positively affects intention to use AI tools. The researcher then measures perceived usefulness and intention to use AI, analyzes the relationship using SmartPLS, and determines whether the empirical evidence supports the hypothesis.

However, theory testing should not be reduced to accepting or rejecting hypotheses. A statistically supported hypothesis does not automatically mean that the theory is fully confirmed. Similarly, an unsupported hypothesis does not necessarily mean that the theory is wrong. Results must be interpreted carefully, considering measurement quality, research context, sample characteristics, model specification, and possible boundary conditions. Theory testing therefore requires both statistical competence and theoretical judgment.

1.5.4 Theory Building and Theory Testing Are Complementary

A common misunderstanding is that theory building and theory testing represent two separate types of research. In reality, they are complementary stages of scientific development. Theory building produces explanations that require empirical evaluation. Theory testing evaluates those explanations and produces findings that may support, refine, or challenge them. When findings do not fully support theoretical expectations, researchers may return to theory building by proposing revised explanations.

This cycle is central to scientific progress. For example, early technology adoption research focused heavily on perceived usefulness and ease of use. Later studies extended these explanations by incorporating social influence, facilitating conditions, trust, risk, habit, and contextual factors. These extensions did not reject earlier theories entirely; rather, they refined and expanded them to explain more complex phenomena.

Therefore, scientific knowledge develops through interaction between theory building and theory testing. Researchers should not view them as competing activities but as mutually reinforcing processes.

1.5.5 Theory Building, Theory Testing, and Research Purpose

The purpose of a study determines whether it emphasizes theory building, theory testing, or both. A study may be primarily *exploratory* when limited prior theory exists. Exploratory research seeks to understand a phenomenon, identify concepts, and generate possible explanations.

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A study may be primarily *confirmatory* when it evaluates hypotheses derived from established theory. Confirmatory research seeks to determine whether existing theoretical relationships are supported by empirical evidence.

A study may be *theory-extending* when it applies an existing theory to a new context, adds new constructs, or proposes new relationships. And, study may be *theory-integrating* when it combines two or more theories to explain a phenomenon more comprehensively.

SmartPLS is often used in studies that combine theory testing and theory development. Because PLS-SEM is suitable for complex models and prediction-oriented research, it is frequently used to evaluate theoretical models while also exploring extensions, mediators, moderators, and context-specific relationships.

However, researchers must be clear about their purpose. A manuscript that claims to build theory but only tests well-established relationships may appear weak. Similarly, a study that claims to test theory but lacks clear theoretical hypotheses may appear unfocused. Clarity of purpose strengthens the entire research design.

1.5.6 When Does a Study Contribute to Theory?

Not every study using a theory makes a theoretical contribution. A study contributes to theory when it improves understanding of a phenomenon in a way that goes beyond simple empirical confirmation. Theoretical contribution may occur when a study:

- Applies a theory to a new and meaningful context.
- Identifies boundary conditions of an existing theory.
- Adds theoretically justified constructs.
- Explains why a relationship differs across contexts.
- Tests mediation or moderation mechanisms.
- Compares competing theoretical explanations.
- Integrates theories to explain a complex phenomenon.
- Challenges assumptions of an existing theory.

For example, applying TAM to AI adoption in higher education may not be sufficient if the study merely repeats established relationships. However, the study may offer theoretical contribution if it explains how trust in AI, ethical concern, or institutional support modifies traditional technology acceptance mechanisms. Thus, contribution depends not only on the use of theory but on what the study does with that theory.

1.5.7 Implications for SmartPLS Researchers

SmartPLS researchers should clearly position their study in relation to theory. Before conducting analysis, researchers should ask:

1. Am I testing an existing theory?
2. Am I extending a theory to a new context?
3. Am I integrating more than one theory?
4. Am I identifying new mechanisms?
5. Am I evaluating boundary conditions?
6. Am I building a new theoretical explanation?

The answer should be visible in the literature review, conceptual framework, hypotheses, analysis, discussion, and conclusion. A strong SmartPLS study does not merely report that paths

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are significant. It explains what the results mean for theory. It shows whether the findings support, refine, extend, or challenge the theoretical explanation guiding the study. This distinction is central to publication-quality research.

Researcher's Note: Do not describe your study as theory building unless it genuinely develops, extends, or refines theoretical explanation. Testing several hypotheses in SmartPLS is not automatically theory building. Theory building requires a clear contribution to explanation.

1.6 Deductive, Inductive, and Abductive Reasoning

Scientific reasoning provides the intellectual foundation for theory-driven research. Depending on the research objective, investigators may employ deductive, inductive, or abductive reasoning to develop, evaluate, or refine scientific theories.

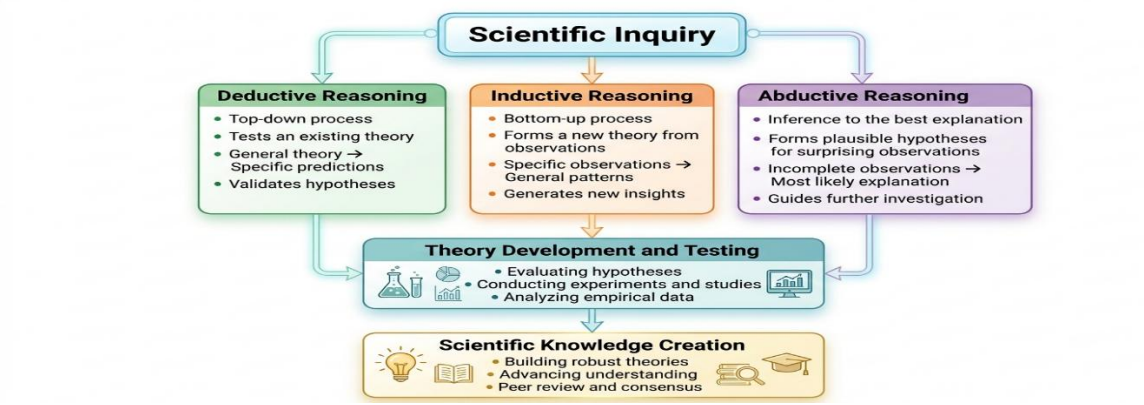

Figure 1.8: Scientific Reasoning in Theory-Driven Research

1.6.1 Introduction

Every scientific investigation involves more than collecting data or applying statistical techniques. At its core, research is an intellectual process through which researchers seek to understand, explain, and predict phenomena. This intellectual process is governed by *scientific reasoning*. Scientific reasoning refers to the logical process through which researchers move from observations to explanations, from explanations to hypotheses, and from empirical evidence to scientific conclusions. It determines how knowledge is generated, evaluated, and refined. Consequently, the quality of research depends not only on methodological rigor but also on the quality of the reasoning that guides the investigation.

In quantitative research, particularly studies employing Structural Equation Modeling (SEM), reasoning influences every stage of the research process. It determines how research questions are formulated, how theories are selected, how hypotheses are developed, and how empirical findings are interpreted. Without sound reasoning, even the most sophisticated statistical analysis cannot produce meaningful scientific knowledge. Throughout the history of science, philosophers have proposed different approaches to reasoning. Among these, three approaches have become particularly influential in contemporary research methodology:

- Deductive reasoning
- Inductive reasoning
- Abductive reasoning

These approaches should not be viewed as competing philosophies. Rather, they represent complementary ways of thinking that serve different research purposes. Understanding when

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and how to use each approach enables researchers to design stronger studies and produce more convincing scientific arguments.

1.6.2 Scientific Reasoning as the Foundation of Research

Scientific reasoning is often described as the bridge between theory and evidence. It allows researchers to connect abstract concepts with empirical observations and to transform isolated findings into coherent scientific knowledge.

Consider the following example. Suppose several universities observe that the adoption of artificial intelligence (AI) tools among faculty members varies considerably despite having similar technological infrastructure. One institution reports high adoption rates, while another reports relatively low levels of AI use. A researcher interested in understanding this phenomenon may approach the problem in several different ways. One researcher may begin with an existing theory such as the Technology Acceptance Model and test whether perceived usefulness and perceived ease of use explain AI adoption.

Another researcher may conduct interviews with faculty members to identify recurring themes before proposing a new conceptual explanation. A third researcher may discover an unexpected finding—for example, that perceived usefulness has little influence on AI adoption in a particular cultural context—and seek an alternative explanation. Although each researcher investigates the same phenomenon, they employ different forms of scientific reasoning. Understanding these differences is essential because the reasoning process influences every methodological decision that follows.

1.6.3 Deductive Reasoning

Deductive reasoning is the most widely used form of reasoning in quantitative research. It begins with an established theory and proceeds toward empirical testing. n deduction, researchers assume that if the underlying theory is correct, and if its assumptions are satisfied, then specific relationships should be observable within empirical data.

The logical sequence is therefore*: Theory → Propositions → Hypotheses → Data Collection → Statistical Testing → Support or Non-support*. Deductive reasoning moves from the general to the specific. Researchers begin with general theoretical principles and derive specific hypotheses that can be evaluated statistically.This approach dominates contemporary behavioral, management, educational, and information systems research because numerous well-established theories already exist. Examples include:

- Technology Acceptance Model (TAM)
- Theory of Planned Behavior (TPB)
- Unified Theory of Acceptance and Use of Technology (UTAUT)
- Diffusion of Innovations (DOI)
- Resource-Based View (RBV)

Each theory proposes general explanations concerning human behavior or organizational phenomena. The researcher's responsibility is to determine whether these theoretical explanations remain valid within a specific research context.

Deductive reasoning begins with an existing theory and proceeds systematically toward empirical evaluation. Statistical evidence is used to determine whether theoretical expectations are supported.

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1.6.4 Deduction in Theory-Driven Research

Theory-driven research is fundamentally deductive. Researchers begin by identifying an appropriate theoretical explanation before collecting any data. The selected theory guides the conceptual framework, construct selection, hypothesis development, and research design. For example, consider a study examining AI adoption among university instructors.

After reviewing the literature, the researcher selects the Technology Acceptance Model (Davis, 1989) because it explains how perceived usefulness and perceived ease of use influence technology adoption. Based on this theory, the researcher develops the following hypothesis:

H1**:** Perceived usefulness positively influences university instructors' intention to adopt AI technologies. This hypothesis is not based on intuition or personal belief. It is derived directly from theoretical reasoning. The researcher then develops a questionnaire, collects data, estimates the structural model using SmartPLS, and evaluates whether empirical evidence supports the proposed relationship.

If the hypothesis is supported, confidence in the theory increases within the investigated context. If the hypothesis is not supported, researchers do not immediately reject the theory. Instead, they investigate possible explanations, including measurement issues, contextual differences, cultural influences, sample characteristics, or theoretical boundary conditions.

Deductive reasoning therefore involves more than confirming or rejecting hypotheses. It requires thoughtful interpretation of empirical evidence within the broader theoretical context.

1.6.5 Advantages and Limitations of Deductive Reasoning

Deductive reasoning possesses several important strengths. First, it provides a clear logical structure that links theory, hypotheses, measurement, and statistical analysis. Second, it facilitates cumulative scientific knowledge because multiple researchers can evaluate the same theoretical propositions across different contexts. Third, it allows findings from independent studies to be compared, integrated, and synthesized through systematic reviews and meta-analyses. Finally, deductive research aligns naturally with quantitative methodologies such as PLS-SEM because both emphasize hypothesis testing and empirical evaluation.

Despite these advantages, deduction also has limitations. Researchers who rely exclusively on existing theories may overlook emerging phenomena that current theories cannot adequately explain. Furthermore, excessive dependence on established theories may discourage theoretical innovation.

For example, applying the Technology Acceptance Model repeatedly without considering context-specific factors may produce statistically valid studies that contribute little new knowledge. Consequently, researchers should recognize that deduction is only one approach to scientific reasoning. Scientific progress also depends upon the generation of new explanations, a process that relies heavily on inductive reasoning, discussed in the next part of this section.

1.6.6 Inductive Reasoning

While deductive reasoning begins with theory, inductive reasoning begins with observation. Researchers employing an inductive approach do not start with predetermined hypotheses or established theoretical explanations. Instead, they collect observations, identify recurring patterns, and gradually develop conceptual explanations that may eventually evolve into theory.

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The logical sequence can be represented as follows: Observations → Patterns → Concepts → Relationships → Proposed Theory. Inductive reasoning therefore moves from the specific to the general. Historically, induction has played a fundamental role in scientific discovery. Before theories can be tested, they must first be developed. Researchers often encounter new phenomena for which existing theories provide insufficient explanation. In such situations, careful observation becomes the starting point for theoretical development.

Consider the emergence of artificial intelligence in higher education. Suppose researchers conduct in-depth interviews with university instructors to understand why they choose to adopt—or avoid—AI technologies. During the interviews, recurring themes begin to emerge, including trust in AI systems, ethical concerns, institutional readiness, digital competence, perceived workload, and academic integrity. Initially, these themes are simply observations.

As additional evidence accumulates, the researcher recognizes meaningful patterns among these observations. These patterns are organized into concepts, relationships are proposed, and eventually a theoretical explanation begins to emerge. Thus, rather than testing an existing theory, the researcher is developing one.

Induction is particularly valuable in areas characterized by rapid technological change, emerging organizational practices, or limited prior research. When knowledge is still evolving, inductive reasoning allows researchers to discover explanations that established theories may overlook. However, inductive reasoning should not be confused with subjective interpretation or unsupported speculation. Strong inductive research follows systematic procedures for data collection, coding, categorization, comparison, and conceptual development. The resulting explanations must remain firmly grounded in empirical observations. Inductive reasoning develops theoretical explanations by identifying patterns emerging from empirical observations

1.6.7 Abductive Reasoning

Deduction begins with theory. Induction begins with observation. Abduction begins with surprise. Abductive reasoning seeks the most plausible explanation for unexpected or anomalous observations. The philosopher Charles Sanders Peirce regarded abduction as the reasoning process responsible for generating new scientific ideas. Unlike deduction, which evaluates existing explanations, or induction, which derives explanations from repeated observations, abduction asks: What explanation best accounts for this unexpected finding?

Suppose a researcher investigates AI adoption among university instructors using the Technology Acceptance Model. Based on theory, the researcher expects perceived usefulness to have a strong positive influence on AI adoption. After analyzing the data using SmartPLS, however, the relationship is found to be statistically insignificant. This result is unexpected. At this stage, deductive reasoning alone cannot explain the finding. The researcher begins asking new questions.

- Could ethical concerns outweigh perceived usefulness?
- Has mandatory institutional policy reduced the importance of perceived usefulness?
- Does trust in AI mediate this relationship?
- Are cultural factors influencing technology adoption differently?

These questions illustrate abductive reasoning. The researcher is not abandoning theory. Nor is the researcher simply describing observations. Instead, the researcher seeks the most plausible explanation for an unexpected result. Abductive reasoning therefore plays a critical role in scientific discovery because it encourages researchers to question assumptions, identify boundary conditions, and develop refined theoretical explanations. Many important scientific

advances have resulted from unexpected findings that existing theories failed to explain adequately.

1.6.8 Comparing Deductive, Inductive, and Abductive Reasoning

Although these reasoning approaches differ in their starting points, they should not be viewed as competing alternatives. Modern research frequently combines them throughout the scientific process. Deduction evaluates existing theories, induction develops new explanations, and abduction improves existing explanations. Table 1.1 summarizes the major differences.

Table 1.1: Comparison of Scientific Reasoning Approaches

Characteristic	Deduction	Induction	Abduction
Starting point	Existing theory	Observation	Unexpected observation
Direction	General → Specific	Specific → General	Surprise → Explanation
Primary objective	Test theory	Build theory	Refine theory
Typical research type	Quantitative	Qualitative	Mixed or iterative
Main outcome	Supported or unsupported hypotheses	New concepts and theoretical propositions	Improved theoretical explanation

Rather than selecting one reasoning approach exclusively, experienced researchers often move among all three approaches during a research project. For example, a study may begin deductively by testing hypotheses derived from an established theory. Unexpected findings may require abductive reasoning to explain anomalies. These explanations may subsequently contribute to inductive development of revised theoretical perspectives. Scientific reasoning is therefore dynamic rather than linear.

Scientific reasoning is cyclical. Theory generates hypotheses, evidence evaluates those hypotheses, unexpected findings stimulate abductive reasoning, and new insights contribute to further theory development.

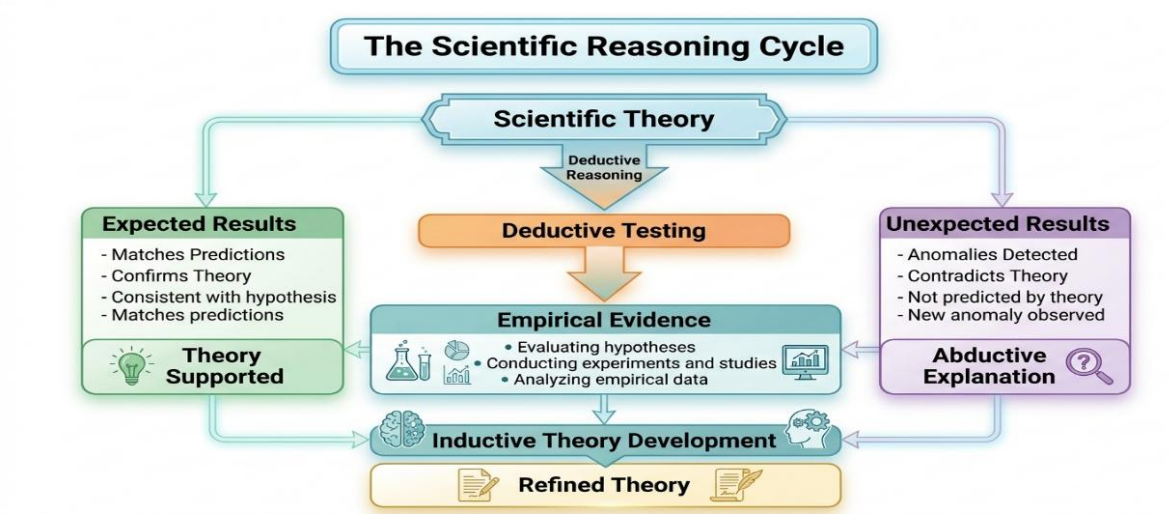

Figure 1.9: The Scientific Reasoning Cycle

1.6.9 Scientific Reasoning in SmartPLS Research

Researchers often associate SmartPLS exclusively with hypothesis testing. This perception is only partially correct. SmartPLS is primarily a tool for evaluating theoretical models through

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empirical evidence, making it naturally compatible with deductive reasoning. However, the interpretation of SmartPLS results frequently requires abductive reasoning, particularly when empirical findings differ from theoretical expectations.

For example, suppose mediation analysis indicates that an expected indirect effect is absent. The statistical result answers the question: *What happened?* The researcher must still answer: *Why did it happen?*. This second question requires theoretical reasoning rather than statistical calculation.

Similarly, repeated findings across multiple SmartPLS studies may encourage researchers to develop new theoretical explanations or propose context-specific extensions. In this sense, inductive reasoning also contributes to theory development based on accumulated empirical evidence. Consequently, SmartPLS should not be viewed merely as statistical software. It is one component of a broader scientific reasoning process in which theory, evidence, and interpretation interact continuously.

Researcher's Note **:** One of the most common misconceptions among beginning researchers is believing that statistical software produces scientific knowledge. It does not. Scientific knowledge emerges from the interaction between *reasoning, theory, evidence, and interpretation*. Software performs calculations, while researchers produce explanations.

1.8 Chapter Summary

Chapter 1 established the foundation for theory-driven quantitative research and introduced the principles that guide the remainder of this book. It emphasized that successful research begins with scientific thinking rather than statistical software. Before selecting analytical techniques such as SmartPLS, researchers must first identify a meaningful research problem and formulate clear research questions that direct the entire research process.

The chapter explained the role of scientific theory as the foundation of quantitative research. Unlike its everyday meaning, a scientific theory provides a systematic explanation of observable phenomena and guides researchers in understanding why relationships among variables exist. Theory therefore serves as the basis for selecting constructs, developing hypotheses, designing measurement instruments, and interpreting research findings.

The distinction between *theory, conceptual framework, and research model* was also clarified. A theory provides the general explanation of a phenomenon, the conceptual framework adapts that explanation to the specific research context, and the research model translates the framework into an empirical structure suitable for statistical testing. Understanding these concepts helps researchers maintain consistency throughout the research process.

The chapter also introduced the three major approaches to scientific reasoning: *deductive, inductive, and abductive* reasoning. While deductive reasoning is the dominant approach in quantitative research and hypothesis testing, inductive and abductive reasoning also contribute to scientific discovery by generating and refining theoretical explanations.

In addition, several common mistakes made by beginning researchers were discussed, including selecting software before defining the research problem, choosing theories without justification, confusing key research concepts, and focusing solely on statistical significance rather than scientific contribution. Avoiding these mistakes requires a systematic, theory-driven approach in which every methodological decision is logically connected to the research objectives.

Key Takeaway: The central message of this chapter is that statistical analysis alone does not create scientific knowledge. Scientific knowledge emerges when empirical evidence is interpreted through appropriate theoretical reasoning. Although SmartPLS is a powerful tool for testing research models, it cannot replace the researcher's responsibility for selecting theories, developing conceptual frameworks, and explaining research findings.

Having established the importance of theory as the foundation of quantitative research, the next chapter builds upon these concepts by demonstrating how researchers conduct a strategic literature review, select appropriate theories, identify research constructs, and develop a theory-driven conceptual framework and research hypotheses suitable for empirical testing using SmartPLS.

1.9 Case Study : Running Research Project;

A Theory-Driven Investigation of Artificial Intelligence Adoption in Higher Education

Purpose of the Running Case Study: Throughout this book, a single research project will be used to demonstrate how a theory-driven study develops from an initial research idea into a publishable journal article. Rather than presenting isolated examples in each chapter, readers will progressively build every component of the same research project, including the research problem, literature review, theory selection, conceptual framework, hypotheses, questionnaire, SmartPLS analysis, interpretation of results, and manuscript preparation. By the end of the book, readers will have completed a full quantitative research project suitable for submission to an international peer-reviewed journal.

*Background***:** Artificial Intelligence (AI) has become one of the most significant technological innovations affecting higher education. Universities increasingly invest in AI-powered tools to support teaching, learning, assessment, student services, research, and administrative decision-making. Applications such as intelligent tutoring systems, generative AI, automated feedback, learning analytics, and virtual assistants are transforming educational practices across the world. Despite these developments, the adoption of AI technologies by university instructors remains inconsistent. While some academics actively integrate AI into their teaching and research activities, others remain reluctant because of concerns related to trust, ethics, academic integrity, institutional support, digital competence, privacy, and professional identity. This variation raises an important scientific question: *Why do some university instructors adopt artificial intelligence technologies while others do not?*. This question forms the foundation of the running research project presented throughout this book.

Stage 1: Research Curiosity: Every research project begins with curiosity. Imagine you are a university lecturer. Over the past year, you notice considerable differences among your colleagues. Some instructors regularly use ChatGPT, Microsoft Copilot, Gemini, intelligent tutoring systems, and AI-based assessment tools. Others avoid these technologies completely. Several colleagues express concerns about plagiarism, reliability, privacy, and ethical implications. Others believe AI significantly improves productivity and teaching effectiveness. As a researcher, you begin asking yourself: *Why do university instructors differ so greatly in their willingness to adopt AI technologies?.* This represents the beginning of scientific inquiry.

Stage 2: Defining the Research Problem; Curiosity alone is insufficient for scientific research. The researcher must transform curiosity into a clearly defined research problem. After reviewing recent literature, the following problem emerges. Although universities are investing heavily in artificial intelligence technologies, adoption among academic staff remains inconsistent. Existing studies have primarily examined technological factors such as perceived usefulness and ease of use. However, less attention has been devoted to understanding how

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institutional support, digital competence, trust in AI technologies, and ethical concerns jointly influence AI adoption within higher education. This statement identifies:

- the phenomenon,
- the knowledge gap,
- and the need for further investigation.

*Stage 3: Research Questions***:** Based on the research problem, the researcher develops the following research questions. Main Research Question: *What factors influence university instructors' adoption of artificial intelligence technologies in higher education*?. Supporting Research Questions:-

1. Does institutional support influence AI adoption?
2. Does digital competence affect AI adoption?
3. Does trust in AI technologies increase adoption?
4. Do ethical concerns reduce AI adoption?
5. Does AI adoption improve teaching innovation?

These questions provide direction for the remainder of the research project.

Stage 4: Thinking Before Choosing Theory; At this stage, the researcher does not immediately select a theory. Instead, the researcher asks several important questions:-

- What exactly am I trying to explain?
- Is this primarily an individual behavioral issue?
- Is it an organizational issue?
- Is it a technological issue?
- Does one theory explain all aspects of the phenomenon?

These questions illustrate an important principle introduced in Chapter 1. *Theory should be selected because it explains the research problem—not because it is popular***.** The process of selecting an appropriate theory will be presented in detail in Chapter 2.

1.10 Analytical Review & Critical Inquiry

Before moving forward, pause to evaluate the core assumptions and structural relationships introduced in this chapter.

📖 A doctoral student selected the Technology Acceptance Model (TAM) because it appeared in most previous studies. Critically evaluate this decision. Would you consider this sufficient justification? Why or why not?

📖 Another researcher developed ten hypotheses without citing any supporting theory. Discuss the methodological weaknesses of this approach.

📖 A researcher reported that all hypotheses were statistically significant but provided almost no discussion of their theoretical implications. Would you consider this study a strong scientific contribution? Justify your answer.

📖 Some researchers argue that sophisticated statistical software has become more important than theory. Do you agree? Support your answer with arguments from this chapter.

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Chapter 2

Building a Theory-Driven Research Model

Chapter Purpose: This chapter demonstrates how researchers transform a research problem into a theory-driven conceptual model. Readers will learn how to conduct a strategic literature review, select an appropriate scientific theory, identify constructs, develop a conceptual framework, formulate hypotheses, and position their research contribution before collecting any data. By the end of the chapter, readers will have a complete research model ready for empirical testing using SmartPLS.

Chapter Learning Objectives

After completing this chapter, readers should be able to:

1. Conduct a strategic literature review.
2. Identify research gaps.
3. Select and justify an appropriate scientific theory.
4. Identify latent constructs from the literature.
5. Develop a conceptual framework.
6. Formulate theory-driven hypotheses.
7. Position the theoretical contribution of a study.
8. Build a complete research model ready for SmartPLS analysis

Introduction

In Chapter 1, we established that successful quantitative research begins with scientific thinking rather than statistical software. We explored the importance of scientific theory, distinguished between theory, conceptual frameworks, and research models, and examined the reasoning processes that underpin scientific inquiry. These concepts provide the intellectual foundation for theory-driven research.

Building on this foundation, Chapter 2 focuses on a practical question faced by every researcher: *How do we transform a research problem into a complete theory-driven research model suitable for empirical testing?*

Developing a research model is one of the most important stages of quantitative research. It requires much more than selecting variables and drawing arrows between them. A strong research model is built through a systematic process of reviewing the literature, identifying research gaps, selecting an appropriate theoretical foundation, defining relevant constructs, developing a conceptual framework, and formulating logically derived hypotheses. Each stage builds upon the previous one to create a coherent model capable of explaining the phenomenon under investigation.

This chapter presents a step-by-step approach to developing a theory-driven research model. Readers will learn how to conduct a strategic literature review, identify meaningful research gaps, select appropriate scientific theories, define latent constructs, construct a conceptual framework, and develop hypotheses supported by both theory and prior research. The chapter

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also explains how researchers position the theoretical contribution of their studies before collecting any data.

Throughout the chapter, we continue the running case study on Artificial Intelligence Adoption in Higher Education, demonstrating how an initial research problem evolves into a complete conceptual model ready for empirical evaluation using SmartPLS. By following this practical example, readers will gain a clear understanding of how theoretical thinking guides every stage of research model development. The central message of this chapter is that strong research models are not created by statistical software. They are developed through critical reading, sound theoretical reasoning, and logical model construction.

2.1 From Research Problem to Literature Review

A literature review is not the first stage of research but the first systematic activity that follows a clearly defined research problem. Its purpose is to understand existing knowledge, identify research gaps, and prepare for theory selection

Figure 2.1**:** From Research Problem to Literature Review

2.1.1 Why Do Researchers Conduct a Literature Review?

Every scientific investigation builds upon previous knowledge. Researchers rarely begin with a completely new idea. Instead, they seek to understand what is already known, what remains uncertain, and where opportunities exist for making a meaningful contribution. The process of examining existing scientific knowledge is known as the literature review.

A literature review is far more than a collection of summaries from published articles. It is a systematic and critical examination of previous research that enables researchers to understand the current state of knowledge within a particular field. More importantly, it helps researchers identify unanswered questions, evaluate competing theoretical explanations, and position their own study within the existing body of literature. For beginning researchers, one of the most common misconceptions is that the purpose of a literature review is simply to demonstrate that many articles have been read. The true purpose of a literature review is to answer several fundamental questions: (These questions transform reading into scientific investigation).

- What is already known about the phenomenon?
- Which theories have been used to explain it?
- What findings have previous studies reported?
- Where do researchers disagree?
- What remains unexplained?
- How can my study contribute to existing knowledge?

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2.1.2 Reading Like a Student versus Reading Like a Researcher

One of the most important transitions in postgraduate education occurs when students stop reading merely to acquire information and begin reading to develop research. Students typically read to understand, while, researchers read to question. This distinction fundamentally changes how scientific articles are approached.

A student reading an article may ask:

- What did the authors discover?
- What statistical method did they use?
- What conclusions did they reach?

A researcher asks different questions:

- Why was this theory selected?
- What assumptions underlie the conceptual framework?
- What limitations remain unresolved?
- Which variables were excluded?
- What opportunities exist for extending this work?
- How does this study contribute to theory?

Consequently, researchers rarely read an article from beginning to end without purpose. Instead, they read strategically, extracting the information needed to build their own research. Developing this habit is one of the most valuable skills in academic research.

2.1.3 Strategic Literature Review

A common mistake among beginning researchers is believing that they must read hundreds of articles before beginning their study. This is neither practical nor necessary. High-quality research depends more on *strategic reading* than on extensive reading.

A strategic literature review focuses on identifying the most relevant and influential publications that directly support the research problem. Rather than attempting to read everything, researchers should concentrate on understanding the development of knowledge within their chosen area. A strategic review normally follows four stages.

Stage 1: Identify the Research Topic; The researcher begins by clearly defining the phenomenon under investigation. For example; Artificial Intelligence Adoption in Higher Education. At this stage, the objective is not to search for every article related to artificial intelligence but to define the boundaries of the investigation.

Stage 2: Identify Search Keywords; Researchers should develop a list of keywords and alternative terms before searching academic databases. Examples include:

- Artificial Intelligence
- AI Adoption
- Technology Adoption
- University Instructors
- Higher Education
- Educational Technology
- Digital Transformation
- Teaching Innovation

Using combinations of keywords generally produces more relevant search results than searching broad topics alone.

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Stage 3: Search High-Quality Sources; Not every publication contributes equally to scientific research. Researchers should prioritize peer-reviewed journals, scholarly books, conference proceedings, and systematic literature reviews published by reputable academic publishers. Quality is always more important than quantity.

Stage 4: Organize the Literature; The final stage involves organizing the collected literature according to themes rather than publication dates. For example, articles may be grouped according to:

- Technology Acceptance
- Artificial Intelligence
- Educational Innovation
- Digital Competence
- Trust
- Ethical Issues

Organizing literature thematically allows researchers to recognize patterns more effectively and simplifies theory selection later in the research process.

2.1.4 Primary and Secondary Sources

Researchers should also distinguish between *primary* and *secondary* sources. A primary source presents original research conducted by the authors. Examples include:

- Journal articles reporting empirical findings.
- Conference papers presenting original studies.
- Doctoral dissertations containing original research.

A secondary source summarizes or interprets previous research. Examples include:

- Literature reviews.
- Systematic reviews.
- Meta-analyses.
- Academic textbooks.

Primary sources provide direct evidence and should generally form the foundation of the literature review. Secondary sources are valuable for understanding the broader development of knowledge but should not replace original research articles.

2.1.5 Organizing the Literature

Collecting articles is only the beginning of the literature review. The researchers must also organize the information efficiently, and one effective approach is to create a literature matrix. For each article, researchers record: *Authors, Year, Research objective, Theory used, Constructs, Methodology, Sample, Main findings, Research limitations.*

This simple process allows researchers to compare studies systematically and identify recurring patterns across the literature. More importantly, it prevents repeatedly reading the same articles and provides a valuable resource when writing the literature review chapter.

Researcher's Note: A literature review is the bridge between a research problem and theory development. Its purpose is not to collect articles but to understand existing knowledge, evaluate previous research, identify meaningful research gaps, and prepare for the development of a theory-driven research model. Effective researchers read strategically, organize information systematically, and focus on building scientific understanding rather than accumulating references.

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2.2 Identifying the Research Gap

A research gap emerges through critical analysis of the literature rather than from the absence of previous studies. Identifying the gap creates an opportunity for scientific contribution.

2.2.1 What Is a Research Gap?

Every scientific study should answer a simple but fundamental question: *Why is this research necessary?.* The answer lies in the identification of a *research gap.*

A research gap is an aspect of scientific knowledge that remains incomplete, insufficiently explained, inconsistent, or unexplored. It represents an opportunity for researchers to extend existing knowledge by addressing questions that previous studies have not answered adequately. Many beginning researchers mistakenly believe that a research gap exists only when no previous studies have been conducted. This misunderstanding often leads students to search endlessly for completely unexplored topics.

In reality, completely new research topics are rare. Most scientific research contributes by improving existing knowledge rather than creating entirely new areas of investigation. For example, hundreds of studies have examined technology adoption. Nevertheless, researchers continue to publish studies in this area because they investigate new populations, integrate different theories, examine additional variables, apply alternative methodologies, or explore emerging technologies such as artificial intelligence. Consequently, a research gap should be viewed not as the absence of research but as an opportunity to improve scientific understanding.

2.2.2 Why Is Identifying the Research Gap Important?

The research gap performs several essential functions. First, it justifies why the study should be conducted. Second, it demonstrates that the researcher understands the existing literature. Third, it provides the logical basis for selecting a scientific theory and developing a conceptual framework. Finally, it establishes the potential contribution of the research.

Without a clearly defined research gap, a study often appears to repeat existing work without adding meaningful knowledge. Reviewers frequently reject manuscripts because authors describe previous studies but fail to explain what remains unknown. The research gap therefore provides the intellectual justification for the entire research project.

2.2.3 A Research Gap Is Not the Absence of Research

One of the most common misconceptions among beginning researchers is expressed as follows: *"There are no studies on my topic, so I have found a research gap".* This conclusion is often incorrect. If no studies exist, the topic may be too new, too narrow, poorly defined, or of limited scientific interest. Conversely, some of the strongest research gaps emerge in areas that have been studied extensively.

Consider the field of artificial intelligence adoption. Thousands of studies have investigated technology adoption, yet researchers continue to publish influential work because they examine new contexts, integrate emerging theories, investigate novel constructs, or explain conflicting findings. Therefore, researchers should avoid asking: *Has anyone studied this topic?.* Instead, they should ask: *What remains insufficiently explained?.* This shift in thinking transforms literature review into scientific inquiry.

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2.2.4 Types of Research Gaps

Research gaps may arise in several different ways. Understanding these categories helps researchers recognize opportunities for scientific contribution.

1. Theoretical Gap

A theoretical gap exists when current theories fail to explain a phenomenon adequately or when competing theories produce different interpretations. Example: Technology Acceptance Model explains technology adoption effectively, but it may not fully explain issues such as trust in generative AI or ethical concerns surrounding artificial intelligence. Possible contribution: Extending an existing theory or integrating multiple theories.

2. Methodological Gap

A methodological gap exists when previous studies have relied heavily on one research method while alternative methods remain underutilized. Example: Most previous studies employed multiple regression analysis. The current study applies PLS-SEM to examine mediation and moderation simultaneously. Methodological improvements should always serve the research question rather than exist merely to use a different statistical technique.

3. Contextual Gap

A contextual gap occurs when existing theories have not been examined within a particular setting. Example: Technology adoption has been studied extensively in business organizations but remains relatively underexplored among university instructors using generative AI. Applying theory in a meaningful new context may strengthen external validity and reveal context-specific relationships.

4. Population Gap

Previous research may focus primarily on one population while overlooking another. Example: Studies investigate undergraduate students but rarely examine faculty members, school administrators, healthcare professionals, or government employees. Changing the population may reveal different theoretical mechanisms.

5. Practical Gap

A practical gap exists when research findings have limited usefulness for practitioners or fail to address real-world problems. Example: Many studies explain AI adoption statistically but provide limited guidance for university administrators seeking to increase faculty adoption. Bridging research and practice represents an important form of scientific contribution.

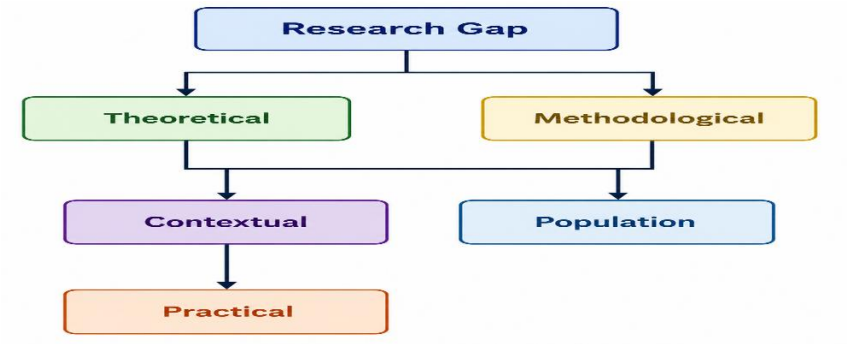

Figure 2.2: Major Types of Research Gaps

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2.2.5 How to Identify a Research Gap

Finding a research gap is not a matter of luck. It is a systematic process of critical reading and comparison. One practical approach involves the following five steps.

Step 1: Read Recent Literature; Begin by reviewing recent studies published in reputable journals. Focus on understanding what researchers investigated, which theories they used, and what conclusions they reached.

Step 2: Compare Findings; Do different studies report consistent results? Are there conflicting findings? Do some variables appear important in one study but not another? Differences among studies often indicate opportunities for further investigation.

Step 3: Examine Limitations; Nearly every published article concludes with a section describing limitations and future research directions. These sections should not be copied directly. Instead, researchers should identify recurring themes across multiple studies. Repeated recommendations often indicate meaningful research opportunities.

Step 4: Evaluate Existing Theories; Ask whether current theories fully explain the phenomenon.

Could another theory provide a better explanation? Would integrating theories improve understanding?

Step 5: Define Your Contribution; Finally, summarize the research gap clearly. An effective gap statement explains:

- What is already known.
- What remains unknown.
- Why the missing knowledge is important.
- How the current study will address the gap.

2.2.6 Example: Identifying a Research Gap

Consider the running case study. Research Topic: Artificial Intelligence Adoption in Higher Education. After reviewing the literature, the researcher observes:

- Most studies examine students rather than instructors.
- Technology Acceptance Model is frequently used.
- Trust in AI receives limited attention.
- Ethical concerns are discussed conceptually but rarely tested empirically.
- Few studies investigate teaching innovation as an outcome of AI adoption.

Based on these observations, the researcher may write: *Although previous studies have examined technology adoption in higher education, limited research has investigated how institutional support, trust in AI, and digital competence jointly influence university instructors' adoption of generative AI technologies and their subsequent teaching innovation.*

Notice that this statement does not claim the topic is completely new. Instead, it identifies a *specific deficiency* within existing knowledge. This is the hallmark of a well-defined research gap.

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Note: A research gap is not simply the absence of previous research. It is a meaningful opportunity to improve scientific understanding by addressing unanswered questions, theoretical limitations, methodological weaknesses, contextual differences, population variations, or practical challenges. Identifying a research gap requires critical analysis of the literature and forms the foundation for theory selection, conceptual framework development, and scientific contribution.

2.3 Selecting an Appropriate Scientific Theory

Scientific theories are selected after the research problem and research gap have been clearly established. Theory provides the conceptual explanation that guides the remainder of the research process.

2.3.1 Why Theory Selection Matters

One of the most important decisions in any research project is selecting the scientific theory that will guide the study. The chosen theory influences every subsequent stage of the research process, including construct identification, conceptual framework development, hypothesis formulation, questionnaire design, statistical analysis, and interpretation of findings.

A strong theory provides a logical explanation for the phenomenon under investigation. It explains *why* certain relationships are expected to exist and allows researchers to develop hypotheses that can be evaluated empirically.

Conversely, selecting an inappropriate theory weakens the entire study. Even if the statistical analysis is technically correct, the research may contribute little to scientific knowledge because the theoretical explanation does not adequately match the research problem. For this reason, theory selection should never be treated as a routine step or a requirement added simply to satisfy university guidelines. It is an intellectual decision that shapes the quality, originality, and scientific contribution of the entire research project.

2.3.2 A Common Mistake: Choosing the Most Popular Theory

Many beginning researchers select a theory using the following reasoning: *"Most previous studies used the Technology Acceptance Model, so I will also use the Technology Acceptance Model".* Although this approach is common, it is scientifically weak. Popularity is not evidence that a theory is the best explanation for every research problem. A theory becomes valuable only when it explains the phenomenon being investigated.

For example, if a researcher wishes to understand individual technology adoption, the Technology Acceptance Model may provide an excellent theoretical foundation. However, if the objective is to explain organizational digital transformation, institutional readiness, or strategic capability, other theories such as the Technology–Organization–Environment (TOE) Framework or the Resource-Based View (RBV) may provide stronger explanations. Researchers should therefore ask: *Which theory best explains my research problem?* rather than *Which theory is used most frequently?*. Theory selection should begin with the research problem. The objective is to identify the theory that provides the strongest conceptual explanation, not simply the one most frequently cited in previous studies.

2.3.3 Characteristics of a Good Scientific Theory

Not every theory is equally appropriate for every study. Before selecting a theory, researchers should evaluate its ability to explain the phenomenon under investigation. A good scientific theory should possess several important characteristics such as:

Explanatory Power; The theory should clearly explain why relationships among constructs are expected to occur. For example, the Theory of Planned Behavior explains how attitudes, subjective norms, and perceived behavioral control influence behavioral intentions. The theory therefore provides a logical explanation for human decision-making.

Relevance; The theory should be relevant to the research problem. A theory developed to explain consumer purchasing behavior may not be appropriate for explaining organizational strategy or information security compliance without careful justification.

Empirical Support; Researchers should prefer theories that have been tested repeatedly across different studies and contexts. A strong body of empirical evidence increases confidence that the theory provides a useful explanation while still allowing opportunities for refinement or extension.

Flexibility; Good theories can often be adapted to new contexts or extended through the inclusion of additional constructs. This flexibility enables researchers to investigate emerging phenomena while maintaining theoretical consistency.

Logical Consistency; The assumptions and relationships proposed by the theory should be internally coherent and free from contradiction.

2.3.4 Comparing Candidate Theories

Table 2.1: Comparing Candidate Theories

Theory	*Primary Focus*	*Suitable For*
Technology Acceptance Model (TAM)	Perceived usefulness and ease of use	Individual technology adoption
Theory of Planned Behavior (TPB)	Attitudes, social influence, behavioral control	Human behavior and intention
Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance expectancy, effort expectancy, social influence, facilitating conditions	Technology adoption in organizational settings
Diffusion of Innovations (DOI)	Characteristics of innovations	Adoption of new technologies over time
Technology–Organization–Environment (TOE)	Organizational and environmental factors	Organizational technology adoption
Resource-Based View (RBV)	Organizational capabilities and strategic resources	Competitive advantage and organizational performance

Researchers should rarely accept the first theory they encounter during the literature review. Instead, they should compare several possible theories before making a decision. Suppose a researcher investigates artificial intelligence adoption among university instructors. Several theories could potentially explain this phenomenon. Each theory offers a different perspective. The researcher's responsibility is to determine which perspective best explains the phenomenon under investigation. Several theories may explain the same phenomenon. Researchers should evaluate competing theories before selecting the one that best aligns with the research problem.

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2.3.5 Should Researchers Use One Theory or Multiple Theories?

There is no universal rule requiring researchers to use either one theory or multiple theories. The decision depends on the complexity of the research problem. Single-Theory Studies; A single theory is often sufficient when it provides a comprehensive explanation of the phenomenon. or example, a study investigating students' acceptance of an online learning system may be explained effectively using the Technology Acceptance Model alone. Single-theory studies are generally easier to justify, simpler to interpret, and more suitable for beginning researchers.

Multi-Theory Studies; More complex research problems may require the integration of multiple theories. For example, AI adoption among university instructors may involve:

- Individual perceptions of technology.
- Organizational support.
- Institutional policies.
- Trust in AI.
- Ethical considerations.

No single theory may explain all these dimensions adequately. Researchers may therefore integrate complementary theories to provide a more comprehensive explanation. However, integrating theories should never be done simply to increase the number of citations or constructs. Each theory must contribute a unique explanatory perspective.

2.3.6 How to Justify Theory Selection

Many theses and journal articles contain a short statement such as: *"The Technology Acceptance Model was selected because it has been widely used in previous studies"*. This justification is weak. A stronger justification explains why the selected theory is conceptually appropriate. For example: *The Technology Acceptance Model was selected because the primary objective of this study is to explain university instructors' adoption of artificial intelligence technologies. The theory specifically explains how perceptions of usefulness and ease of use influence technology adoption decisions and has been extensively validated in information systems research. Furthermore, its constructs align closely with the research problem investigated in this study.* Notice that this justification focuses on explanatory power rather than popularity.

2.3.7 Running Case Study

Returning to the running case introduced in Chapter 1, the researcher has identified the following research problem: *Why do university instructors differ in their adoption of artificial intelligence technologies?.* After reviewing the literature, several theories emerge as possible candidates. The researcher compares TAM, TPB, UTAUT, DOI, and TOE.

Although each theory explains part of the phenomenon, the literature suggests that UTAUT provides the most comprehensive explanation of technology adoption within organizational settings because it incorporates performance expectancy, effort expectancy, social influence, and facilitating conditions. However, the literature also indicates that recent studies increasingly recognize the importance of *trust in AI* and *ethical concerns*, constructs that are not fully captured by UTAUT. This observation creates an opportunity for theory extension, a topic that will be explored later in the chapter.

*Researcher's Note***:** Scientific theory provides the intellectual foundation of quantitative research. Theory selection should always begin with the research problem and be based on explanatory power rather than popularity. By carefully evaluating competing theories and

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selecting the one that best explains the phenomenon under investigation, researchers establish a strong conceptual foundation for developing constructs, conceptual frameworks, hypotheses, and empirical models suitable for SmartPLS analysis.

2.4 Identifying Research Constructs

Research constructs emerge from scientific theory and the literature. They provide the conceptual building blocks of the research model.

2.4.1 What Is a Research Construct?

After selecting an appropriate scientific theory, the next task is to identify the *constructs* that will be investigated. Every quantitative research model is built from constructs. Without clearly defined constructs, it is impossible to develop hypotheses, design questionnaires, or perform statistical analysis.

A *construct* is an abstract concept developed to represent a characteristic, idea, behavior, attitude, or phenomenon that cannot be observed directly but can be measured indirectly through one or more indicators. Examples of research constructs include:

- Trust
- Satisfaction
- Organizational Commitment
- Perceived Usefulness
- Digital Competence
- Teaching Innovation
- Information Security Awareness
- Behavioral Intention

Unlike physical characteristics such as age or income, constructs are theoretical concepts. They exist at the conceptual level and therefore require measurable indicators to represent them empirically. For example***, trust in artificial intelligence*** cannot be observed directly. Instead, researchers measure trust using questionnaire items that assess respondents' confidence in AI technologies. The responses to these items collectively represent the underlying construct. Constructs therefore provide the bridge between theory and empirical measurement.

2.4.2 Constructs versus Variables

Beginning researchers often use the terms *construct* and *variable* interchangeably. Although related, they are not identical. A *construct* is a theoretical concept. A *variable* is the measurable representation of that construct within a research study. For example, The construct: *Perceived Usefulness;* may be measured using questionnaire statements such as:

- Using AI improves my teaching performance.
- AI increases my productivity.
- AI helps me complete academic tasks more efficiently.

Each response becomes observed data. Together, these observations represent the theoretical construct. In other words, Theory defines constructs. Research measures variables. Understanding this distinction becomes especially important when working with latent variables in SmartPLS. A construct is a theoretical concept that becomes measurable through indicators and questionnaire items.

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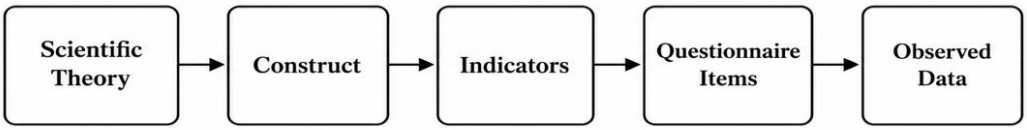

Figure 2.3: From Construct to Measurement

2.4.3 Constructs versus Indicators versus Questionnaire Items

Another source of confusion concerns the relationship between constructs, indicators, and questionnaire items. These terms represent different levels of measurement. A *construct* is the theoretical concept. An *indicator* is an observable measure that reflects or forms the construct. A *questionnaire item* is the actual statement presented to respondents. Consider the construct: *Teaching Innovation;* Possible indicators might include:

- Use of innovative teaching methods.
- Integration of digital technologies.
- Development of creative learning activities.

One questionnaire item could be: *I regularly use innovative digital tools to improve student learning.* Thus, Questionnaire items measure indicators. Indicators measure constructs. Constructs represent theoretical concepts. Maintaining this hierarchy ensures conceptual clarity throughout the research process.

2.4.4 Where Do Research Constructs Come From?

One of the most common questions asked by postgraduate students is: *"How do I decide which constructs to include in my study?".* The answer is straightforward. Researchers *do not invent constructs.* Instead, they identify constructs through a systematic review of:

- Scientific theory.
- Previous empirical studies.
- Systematic literature reviews.
- Meta-analyses.
- Established measurement scales.

Suppose the researcher selects the Unified Theory of Acceptance and Use of Technology (UTAUT). The theory already identifies several important constructs, including:

- Performance Expectancy
- Effort Expectancy
- Social Influence
- Facilitating Conditions

These constructs become the starting point for model development. The researcher may then identify additional constructs from recent literature, such as:

- Trust in AI
- Digital Competence
- Ethical Concern

However, every additional construct must have a clear theoretical and empirical justification. Adding variables simply because they appear interesting weakens the conceptual integrity of the research model. Research constructs should emerge from theory and supporting literature rather than personal preference.

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2.4.5 Types of Constructs in a Research Model

Once constructs have been identified, researchers classify them according to their role within the conceptual framework. *Independent Constructs;* Independent constructs influence other constructs within the model. Examples:

- Institutional Support
- Digital Competence
- Trust in AI

Dependent Constructs; Dependent constructs represent the outcomes researchers seek to explain. Examples:

- AI Adoption
- Teaching Innovation
- User Satisfaction

Mediating Constructs; A mediator explains *how or why* one construct influences another. For example, AI Adoption may mediate the relationship between Digital Competence and Teaching Innovation.

Moderating Constructs; A moderator influences the *strength or direction* of a relationship. For example, Teaching Experience may moderate the relationship between Trust in AI and AI Adoption.

Control Variables; Control variables are included to account for alternative explanations. Examples include:

- Age
- Gender
- Academic Rank
- Years of Experience

Although they are not the primary focus of the study, they help improve the accuracy of the research model. Constructs perform different roles within a conceptual framework. Understanding these roles is essential before developing hypotheses and building the research model.

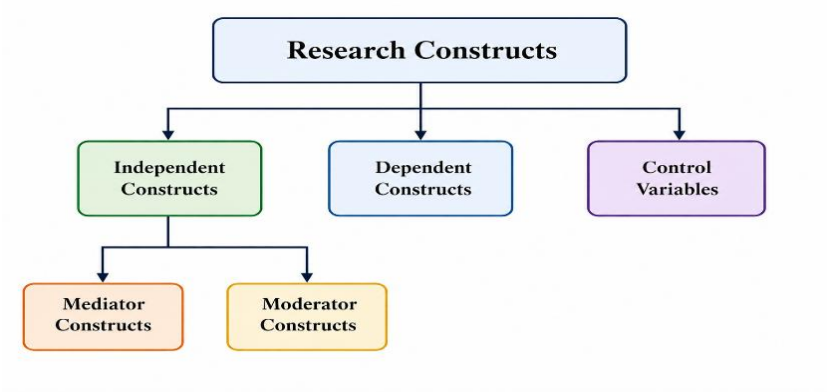

Figure 2.4: Classification of Research Constructs

2.4.6 Running Case Study

Returning to the AI adoption project, the literature review identified the following constructs. *Independent Constructs* **(** Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Trust in AI, Digital Competence). *Dependent Construct(*AI Adoption). *Outcome Construct (*Teaching Innovation). Possible control variables (Gender, Academic Rank, Teaching Experience).

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At this stage, the researcher is *not yet drawing arrows or developing hypotheses*. Instead, the objective is to identify and justify the constructs that will later become part of the conceptual framework. This distinction is important. Researchers should first *determine what concepts belong in the model* before deciding *how those concepts are related*.

2.4.7 Principles for Selecting Constructs

Before finalizing the construct list, researchers should ask several important questions.

- Does each construct originate from theory?
- Is each construct supported by previous empirical research?
- Does each construct contribute to explaining the research problem?
- Is there conceptual overlap between constructs?
- Can each construct be measured using validated indicators?
- Does each construct contribute to the theoretical contribution of the study?

If the answer to these questions is **yes**, the construct is likely appropriate for inclusion in the conceptual framework.

Researcher's Note: One of the easiest ways to weaken a research model is to include constructs without theoretical justification. Every construct should answer one simple question: *Why does this construct belong in my model?* If that question cannot be answered using theory and the literature, the construct probably does not belong in the study.

2.5 Building the Conceptual Framework

The conceptual framework connects theory with empirical research. It organizes the constructs identified from theory and illustrates the relationships that will later be tested statistically.

2.5.1 What Is a Conceptual Framework?

After selecting an appropriate scientific theory and identifying the relevant research constructs, the next step is to organize those constructs into a logical structure that explains the phenomenon under investigation. This structure is known as the *conceptual framework*. A conceptual framework is a visual and conceptual representation of the relationships among the constructs included in a research study. It translates theoretical ideas into a coherent explanation of how and why different constructs are expected to influence one another.

Many beginning researchers believe that a conceptual framework is simply a diagram containing boxes connected by arrows. Although diagrams are important, they represent only the visible part of the framework. The true value of a conceptual framework lies in the theoretical reasoning that supports every relationship shown in the diagram. A well-developed conceptual framework answers three fundamental questions:

- *What* constructs are included in the study?
- *How* are these constructs related?
- *Why* are these relationships expected to exist?

If the framework cannot answer all three questions, it is incomplete.

2.5.2 The Purpose of a Conceptual Framework

The conceptual framework serves as the blueprint for the entire research project. It provides a clear roadmap that links the research problem, scientific theory, hypotheses, measurement, and statistical analysis. A strong conceptual framework performs several important functions.

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First, it organizes the major constructs identified from the literature into a logical structure. Second, it illustrates the expected relationships among those constructs. Third, it demonstrates how the selected theory explains the research problem. Fourth, it provides the foundation for hypothesis development. Finally, it guides the design of the measurement instrument and the subsequent SmartPLS analysis. Without a conceptual framework, research often becomes a collection of unrelated variables rather than a coherent scientific investigation. The conceptual framework occupies a central position in the research process. It connects theory with every subsequent stage of the study.

2.5.3 Components of a High-Quality Conceptual Framework

Although conceptual frameworks differ across disciplines, most high-quality frameworks contain four essential components.

Research Constructs; The framework should include only constructs that are theoretically relevant to the research problem. Every construct should have a clear definition and strong support from both theory and previous empirical studies.

Expected Relationships; The framework should specify how the constructs are expected to influence one another. These relationships should not be based on intuition or personal opinion. They must be supported by theoretical reasoning and empirical evidence.

Direction of Influence; The framework should clearly indicate the direction of each relationship. For example:

- Institutional Support → AI Adoption
- AI Adoption → Teaching Innovation

Directional arrows communicate the theoretical assumptions that will later be tested empirically.

Theoretical Foundation; Every relationship shown in the framework should be traceable to the selected scientific theory. If a relationship cannot be justified theoretically, it should not appear in the conceptual framework.

2.5.4 Principles for Developing a Strong Conceptual Framework

A high-quality conceptual framework follows several important principles.

Principle 1: Begin with Theory; The framework should always originate from the selected scientific theory. Researchers should never begin by drawing arrows between variables simply because they appear statistically interesting. Theory must determine the structure of the framework.

Principle 2: Keep the Framework Focused; Beginning researchers often attempt to include every interesting variable they encounter during the literature review. This approach usually produces an overly complex framework that is difficult to justify and interpret. A stronger framework contains only constructs that directly contribute to explaining the research problem.

Simplicity supported by theory is preferable to unnecessary complexity.

Principle 3: Ensure Logical Flow; Relationships within the framework should follow a logical sequence. Independent constructs influence mediators. Mediators explain mechanisms. Dependent constructs represent outcomes. The framework should tell a coherent theoretical story.

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Principle 4: Avoid Isolated Constructs; Every construct should play a meaningful role within the framework. Variables that are not connected theoretically should not be included simply because data are available.

Principle 5: Maintain Theoretical Consistency; When multiple theories are integrated, researchers must ensure that the theories are conceptually compatible. Combining unrelated theories without justification weakens the framework and confuses readers.

A strong conceptual framework is guided by theory, supported by evidence, and designed for empirical testing.

2.5.5 Common Weaknesses in Conceptual Frameworks

Editors and thesis examiners frequently identify similar weaknesses in conceptual frameworks developed by beginning researchers. Common problems include:

- Including constructs without theoretical justification.
- Adding variables solely because they were significant in previous studies.
- Mixing unrelated theories.
- Drawing relationships that are not explained in the literature review.
- Developing frameworks that are unnecessarily complex.
- Omitting important constructs identified by the selected theory.

These weaknesses often lead to poorly justified hypotheses and limited theoretical contribution. A conceptual framework should therefore be evaluated critically before moving to hypothesis development.

2.5.6 Running Case Study

Returning to the running case study, the researcher has completed the literature review, identified the research gap, selected the Unified Theory of Acceptance and Use of Technology (UTAUT), and identified the relevant constructs. The next step is to organize these constructs into a conceptual framework. The researcher proposes that:

- Performance Expectancy positively influences AI Adoption.
- Effort Expectancy positively influences AI Adoption.
- Social Influence positively influences AI Adoption.
- Facilitating Conditions positively influence AI Adoption.
- Trust in AI positively influences AI Adoption.
- Digital Competence positively influences AI Adoption.
- AI Adoption positively influences Teaching Innovation.

Rather than viewing these relationships independently, the researcher organizes them into a single theoretical explanation of AI adoption among university instructors. This conceptual framework now provides the foundation for developing hypotheses in the next section.

The initial conceptual framework for the running case study. The framework is theory-driven, logically organized, and ready for hypothesis development.

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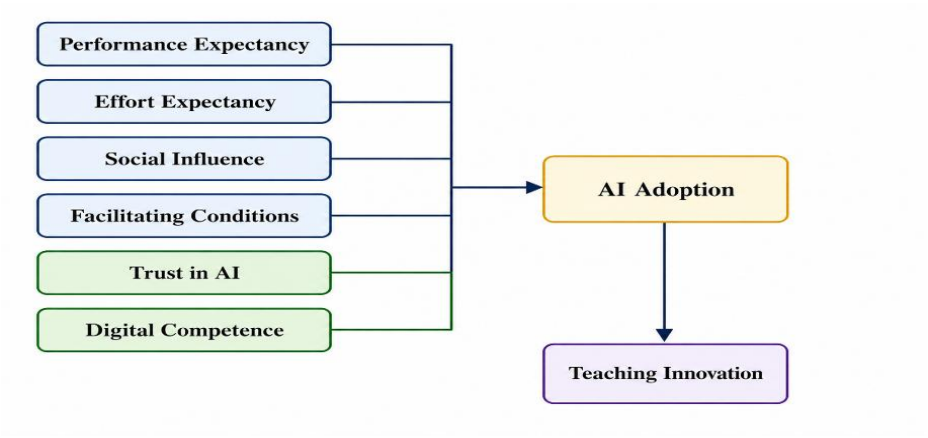

Figure 2.5: Running Case Study: Initial Conceptual Framework

2.5.7 Evaluating Your Conceptual Framework

Before proceeding to hypothesis development, researchers should critically evaluate their framework. Ask yourself the following questions:

- Does every construct originate from theory?
- Is every relationship supported by previous research?
- Does the framework clearly explain the research problem?
- Is the framework logically organized?
- Is the framework unnecessarily complex?
- Can every construct be measured?
- Can every relationship be tested empirically using SmartPLS?

If the answer to these questions is **yes**, the framework is likely ready for hypothesis development.

*Researcher's Note***:** A conceptual framework is *not a drawing exercise*. It is a visual summary of your theoretical thinking. Every box represents a construct supported by theory. Every arrow represents a relationship supported by logic and evidence. If you cannot explain why an arrow exists, it should not appear in your framework.

2.6 Developing Theory-Based Hypotheses

Research hypotheses are derived from theory through the conceptual framework. They provide the link between theoretical reasoning and empirical testing.

Figure 2.6: From Theory to Hypothesis Development

2.6.1 What Is a Research Hypothesis?

Once the conceptual framework has been developed, the researcher is ready to formulate hypotheses. A hypothesis is a clear, logical, and testable statement that predicts the expected relationship between two or more constructs. A hypothesis is not a personal belief, an

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assumption, or a guess. It is a prediction derived from scientific theory and supported by evidence from previous research.

For example, the Technology Acceptance Model (TAM) proposes that individuals are more likely to adopt a technology if they perceive it as useful. Based on this theoretical explanation, a researcher may formulate the following hypothesis: *H1***:** Perceived usefulness positively influences the adoption of artificial intelligence technologies. Notice that the hypothesis is not based on intuition. It is derived directly from the theoretical proposition proposed by TAM. This distinction is essential. If a hypothesis cannot be traced back to a scientific theory, it lacks a strong theoretical foundation.

2.6.2 Why Are Hypotheses Important?

Hypotheses perform several important functions in quantitative research. First, they transform abstract theoretical ideas into statements that can be tested using empirical data. Second, they provide direction for data collection and statistical analysis. Third, they establish the relationships that will be evaluated in the structural model. Finally, they allow researchers to determine whether empirical evidence supports the theoretical explanation.

Without hypotheses, quantitative research lacks direction. Researchers may collect large amounts of data, but without clearly defined predictions, the results become difficult to interpret. In theory-driven research, hypotheses ensure that empirical testing remains closely connected to scientific reasoning. Hypotheses translate theoretical explanations into relationships that can be evaluated through empirical analysis.

2.6.3 Characteristics of a Good Hypothesis

A high-quality hypothesis should possess several characteristics. *Theoretically Justified;* Every hypothesis should originate from the selected scientific theory and be supported by previous empirical research. *Clear;* The relationship between constructs should be stated clearly and without ambiguity. Poor example: Technology is important. A Better example: Perceived usefulness positively influences behavioral intention to use artificial intelligence technologies.

Specific; The constructs involved in the relationship should be clearly identified. Researchers should avoid vague statements such as "technology affects performance". Instead, specify the constructs being investigated. *Testable;* The proposed relationship must be capable of empirical evaluation using measurable indicators. Relationships that cannot be measured cannot be tested scientifically.

Directional; Whenever theory supports a specific direction, researchers should state it explicitly. Examples include: positively influences, negatively influences, increases, decreases. Directional hypotheses improve clarity and facilitate statistical testing.

2.6.4 Types of Hypotheses in SmartPLS Research

Modern PLS-SEM studies frequently employ several different types of hypotheses. Understanding these categories helps researchers build more sophisticated research models.

Direct Effect Hypotheses; These hypotheses examine whether one construct directly influences another. Example:

*H1***:** Performance Expectancy positively influences AI Adoption.

Mediating Effect Hypotheses; A mediation hypothesis explains *how* or *why* one construct affects another. Example:

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H2: AI Adoption mediates the relationship between Digital Competence and Teaching Innovation. Rather than examining only the direct relationship, mediation investigates the underlying mechanism connecting the constructs.

Moderating Effect Hypotheses; Moderation *examines when, for whom, or under what conditions* a relationship changes. Example:

H3: Teaching Experience moderates the relationship between Trust in AI and AI Adoption. Moderators do not explain the relationship. They influence its strength or direction.

Higher-Order Hypotheses; Some studies investigate higher-order constructs composed of several lower-order dimensions. For example, Digital Readiness may consist of: Digital Skills, Digital Infrastructure, Digital Culture

Researchers may hypothesize that the higher-order construct influences another variable within the structural model. Although higher-order models are discussed in later chapters, researchers should recognize that hypotheses can involve both first-order and higher-order constructs.

2.6.5 Writing Strong Hypotheses

The wording of hypotheses should be simple, direct, and consistent. Consider the following examples. Weak hypothesis: Technology affects innovation. Improved hypothesis: *H1:* Artificial intelligence adoption positively influences teaching innovation among university instructors.

Weak hypothesis: Digital skills are important. Improved hypothesis: *H2:* Digital competence positively influences artificial intelligence adoption. Notice that the improved hypotheses clearly identify: the independent construct, the dependent construct, and the expected direction of the relationship.

2.6.6 Common Mistakes in Hypothesis Development

Beginning researchers frequently make similar mistakes. *Writing hypotheses without theory.* Every hypothesis must originate from theoretical reasoning. Using vague language. Terms such as "important" or "related" should be replaced with precise directional statements. Including too many hypotheses. More hypotheses do not necessarily produce better research. A focused model with theoretically justified relationships is generally stronger than an unnecessarily complex model.

Ignoring previous empirical findings. Although hypotheses originate from theory, previous empirical evidence strengthens their justification. Researchers should integrate both theoretical arguments and empirical support.

Treating hypotheses as conclusions. A hypothesis is a prediction, not an established fact. Its purpose is to be evaluated using empirical evidence.

2.6.7 Running Case Study

Returning to the AI adoption study, the conceptual framework developed in the previous section is now translated into theory-based hypotheses. Examples include:

H1: Performance Expectancy positively influences AI Adoption.

H2: Effort Expectancy positively influences AI Adoption.

H3: Social Influence positively influences AI Adoption.

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H4: Facilitating Conditions positively influence AI Adoption.

H5: Trust in AI positively influences AI Adoption.

H6: Digital Competence positively influences AI Adoption.

H7: AI Adoption positively influences Teaching Innovation.

Each hypothesis originates from the selected theoretical foundation and reflects the expected relationships identified within the conceptual framework. The next stage of the research process will involve designing measurement instruments capable of evaluating these hypotheses empirically.

2.6.8 Evaluating Your Hypotheses

Before moving to measurement development, researchers should evaluate each hypothesis using the following checklist. Ask yourself:

- Is the hypothesis derived from theory?
- Is it supported by previous empirical research?
- Are the constructs clearly identified?
- Is the relationship directional?
- Can the hypothesis be tested using empirical data?
- Does the hypothesis contribute to answering the research question?

If the answer to each question is *yes*, the hypothesis is ready for empirical investigation. Research hypotheses represent the bridge between scientific theory and empirical testing. They should be derived logically from the conceptual framework, supported by theory and previous research, clearly written, and suitable for empirical evaluation using SmartPLS. Strong hypotheses strengthen both the theoretical foundation and the scientific contribution of a research study.

2.7 Positioning the Theoretical Contribution

A theoretical contribution begins with a clearly identified research gap and ends with the advancement of scientific knowledge. The contribution should be evident before empirical testing begins.

2.7.1 What Is a Theoretical Contribution?

One of the most common misunderstandings among beginning researchers is the belief that a study contributes to knowledge only after statistically significant results have been obtained. This belief is incorrect. A *theoretical contribution* is the way in which a study advances scientific understanding of a phenomenon. It explains what new knowledge the research is expected to provide and how that knowledge extends, refines, confirms, or challenges existing theories. The contribution is not determined by the statistical software used, the size of the sample, or the number of significant hypotheses. Instead, it depends on the extent to which the study improves theoretical understanding. A researcher should therefore be able to answer the following question before collecting data: *How will my study improve what researchers currently know about this phenomenon?* If this question cannot be answered clearly, the study may lack a meaningful theoretical contribution.

2.7.2 Theoretical Contribution versus Empirical Findings

Beginning researchers often confuse *theoretical contribution* with *empirical findings*. These concepts are related but different. An empirical finding is the result obtained after analyzing the

data. For example: *Performance Expectancy positively influences AI Adoption.* This is an empirical result. The theoretical contribution explains *why this result matters*. For example:

This study extends the Unified Theory of Acceptance and Use of Technology (UTAUT) by demonstrating that trust in artificial intelligence provides additional explanatory power beyond the original UTAUT constructs in the context of higher education.

Notice the difference. The first statement reports a statistical outcome. The second explains how scientific knowledge has been advanced. Researchers should always move beyond reporting results to explaining their theoretical significance.

2.7.3 Forms of Theoretical Contribution

Scientific contribution can take many forms. Researchers do not need to develop an entirely new theory to make a valuable contribution. The following are among the most common forms of theoretical contribution.

Theory Confirmation; A study may confirm that an existing theory remains valid in a different setting or population. For example, demonstrating that UTAUT explains AI adoption among university instructors in developing countries strengthens confidence in the theory's applicability across contexts. Although theory confirmation is generally considered a modest contribution, it is still valuable when applied to important or under-researched settings.

Theory Extension; Theory extension occurs when researchers add new constructs, relationships, or mechanisms to an existing theory. For example, integrating *Trust in AI* into UTAUT to explain AI adoption extends the theory by addressing factors not included in its original formulation. Theory extension is one of the most common contributions in contemporary quantitative research.

Theory Refinement; Theory refinement improves an existing theory by clarifying relationships, redefining concepts, or identifying conditions under which the theory operates more effectively. For example, a study may show that the relationship between social influence and AI adoption depends on institutional culture, thereby refining the theoretical explanation.

Theory Integration; Some research problems are too complex to be explained by a single theory. Researchers may therefore combine complementary theories. For example: UTAUT explains technology adoption.

Institutional Theory explains organizational pressures; Together, these theories provide a more comprehensive explanation than either theory alone. Theory integration requires careful justification to ensure conceptual consistency.

New Context; Applying an established theory to a new and meaningful context may also contribute to knowledge. Examples include: AI adoption in higher education, Blockchain adoption in healthcare, Information security compliance in government agencies. The contribution arises not because the theory is new, but because the context provides new insights into its applicability.

Identifying Boundary Conditions; A study may demonstrate that a theory explains behavior only under certain conditions. For example, Trust in AI may become important only when AI systems perform high-risk academic tasks. Identifying such boundary conditions helps researchers understand where a theory is applicable and where modifications may be required.

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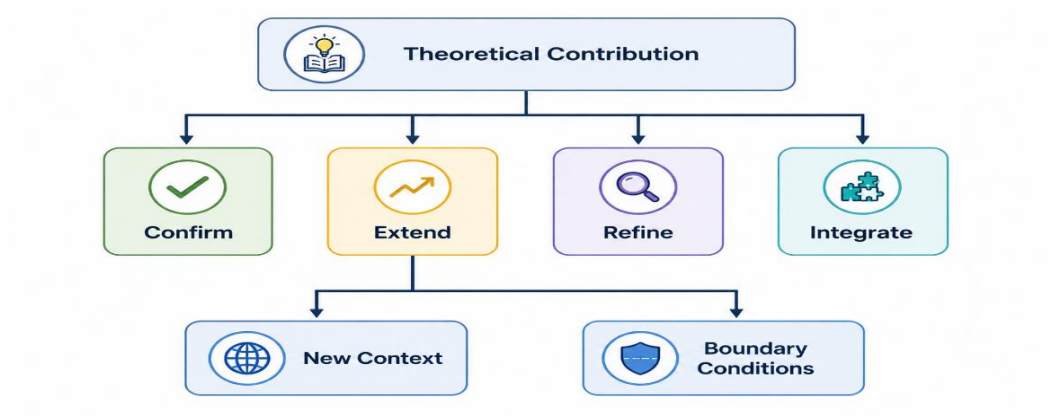

Figure 2.7: Common Forms of Theoretical Contribution

2.7.4 Positioning Your Study

One of the most effective ways to demonstrate contribution is to position the study within the existing literature. Researchers should clearly explain:

- What previous studies have established.
- What limitations remain.
- What the current study adds.
- Why this addition is important.

This positioning creates a logical argument leading from the research gap to the expected contribution. For example: *Previous studies have primarily examined AI adoption using traditional technology acceptance theories. However, limited attention has been given to the role of trust in AI within higher education. This study addresses this gap by extending UTAUT through the inclusion of Trust in AI and examining its influence on university instructors' adoption of generative AI technologies.* This statement identifies the existing knowledge, the limitation, and the intended contribution.

2.7.5 Writing the Theoretical Contribution

Many students find it difficult to write the theoretical contribution section of a thesis or journal article. The following structure provides a practical guide.

Step 1: State the Existing Knowledge. What does the literature already know?

Step 2: Identify the Limitation. What remains unexplained?

Step 3: Explain What the Study Adds. What new theoretical understanding will the study provide?

Step 4: Explain Why It Matters. How does this improve scientific understanding?

Using this four-step approach helps researchers develop clear and convincing contribution statements.

2.7.6 Running Case Study

Returning to the AI adoption study, the researcher has completed the literature review, identified the research gap, selected UTAUT, developed the conceptual framework, and formulated the hypotheses. The researcher now positions the expected contribution as follows.

This study extends the Unified Theory of Acceptance and Use of Technology by incorporating Trust in AI and Digital Competence into the original theoretical model. It also applies the extended framework to university instructors, a population that has received relatively limited attention in previous AI adoption research. Furthermore, the study examines Teaching

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Innovation as an outcome of AI adoption, thereby providing a more comprehensive understanding of the educational impact of AI technologies in higher education.

Notice that this contribution is stated *before* any data have been collected. The researcher is explaining the expected theoretical value of the study rather than predicting statistical outcomes.

2.7.7 Checklist for Evaluating Your Contribution

Before beginning data collection, ask yourself the following questions.

- Does my study address a genuine research gap?
- Does it improve theoretical understanding?
- Does it extend, refine, integrate, or confirm an existing theory?
- Does it examine a meaningful new context or population?
- Can I explain my contribution in two or three clear sentences?
- Would another researcher immediately understand why my study matters?

If the answer to these questions is **yes**, your research is likely to have a well-defined theoretical contribution. A theoretical contribution explains how a study advances scientific knowledge. It is established through a clear research gap, an appropriate theoretical foundation, and a well-justified conceptual framework—not through statistical significance alone. By positioning a study carefully within the existing literature, researchers demonstrate why their work matters and how it contributes to the continued development of scientific theory.

2.8 Chapter Summary

Chapter 2 demonstrated how researchers transform a research problem into a complete theory-driven research model. Building on the foundations established in Chapter 1, the chapter emphasized that successful quantitative research requires systematic thinking supported by scientific theory and evidence from the literature.

The chapter introduced the strategic literature review as the starting point for model development, showing how researchers identify existing knowledge, evaluate previous studies, and recognize meaningful research gaps. It explained that research gaps may arise from theoretical, methodological, contextual, population, or practical limitations, providing the justification for new research.

The chapter also examined the process of selecting an appropriate scientific theory and identifying relevant research constructs. Readers learned how constructs are classified according to their roles within a conceptual framework and how these constructs are organized into a coherent research model. The conceptual framework was presented as a visual representation of theoretical reasoning, providing the foundation for developing logically derived, theory-based hypotheses.

Finally, the chapter highlighted the importance of positioning the theoretical contribution of a study before data collection. Rather than relying on statistical significance alone, meaningful research contributes by confirming, extending, refining, integrating, or applying existing theory in new contexts.

Throughout the chapter, the running case study on *Artificial Intelligence Adoption in Higher Education* illustrated how a research problem evolves into a complete conceptual model ready for empirical investigation. Having established the theoretical foundation and research model,

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the next chapter explains how these concepts are translated into measurable constructs, questionnaire items, and valid measurement instruments for analysis using SmartPLS.

2.9 Running Case Study: Continuing the AI Adoption Research Project

Purpose of the Case Study

In Chapter 1, we identified the research problem and formulated the research questions for the study Artificial Intelligence Adoption in Higher Education. In this chapter, the focus shifts to developing a complete theory-driven research model. By the end of the case study, the researcher will have conducted a literature review, identified a research gap, selected an appropriate theory, developed a conceptual framework, formulated hypotheses, and positioned the expected theoretical contribution.

Step 1: Research Problem: The study investigates why AI adoption among university instructors remains inconsistent despite growing institutional investment in AI technologies. Existing studies have focused primarily on students or general technology adoption, leaving important questions about faculty adoption and its impact on teaching innovation.

*Step 2: Literature Review and Research Gap***:** A review of recent studies reveals that UTAUT is widely used to explain technology adoption. However, three important gaps remain:

- Limited attention to Trust in AI and Digital Competence.
- Limited research focusing on university instructors.
- Limited investigation of Teaching Innovation as an outcome of AI adoption.

These observations justify the need for an extended research model.

*Step 3: Selecting the Theory***:** After comparing several technology adoption theories, the researcher selects the Unified Theory of Acceptance and Use of Technology (UTAUT) because it provides a strong theoretical foundation for explaining AI adoption. To better reflect current AI research, the model is extended by incorporating Trust in AI and Digital Competence.

Step 4: Identifying the Research Constructs: The proposed model includes the following constructs:

- Independent Constructs: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Trust in AI, and Digital Competence.
- Dependent Construct: AI Adoption.
- Outcome Construct: Teaching Innovation.
- Control Variables: Age, Gender, Academic Rank, and Teaching Experience.

Step 5: Developing the Conceptual Framework: Using the selected theory and identified constructs, the researcher develops the conceptual framework , illustrating the proposed relationships among the constructs.

Step 6: Developing the Hypotheses: Seven hypotheses are formulated to examine the relationships proposed in the conceptual framework. Each hypothesis is derived from UTAUT and supported by previous empirical studies.

Step 7: Positioning the Contribution: The study extends UTAUT by integrating Trust in AI and Digital Competence, applies the model to university instructors, and examines Teaching Innovation as an important outcome of AI adoption. These extensions provide the expected theoretical contribution of the study.

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2.10 Analytical Review & Critical Inquiry

📖 Can a study make a valuable scientific contribution without proposing a completely new theory? Discuss your answer with examples.

📖 Should researchers always integrate multiple theories into one study? Discuss the advantages and potential disadvantages.

📖 How can a researcher distinguish between an interesting research topic and a meaningful research problem?

📖 A researcher claims: "My contribution is that all of my hypotheses were statistically significant." Do you agree? Explain why or why not.

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Chapter 3

Designing the Measurement Model

Chapter Purpose: After developing a theory-driven research model in Chapter 2, researchers must transform abstract theoretical constructs into measurable variables. This chapter explains how to operationalize constructs, select or develop measurement items, distinguish between reflective and formative measurement models, and prepare a valid and reliable research instrument for empirical testing using SmartPLS.

The chapter emphasizes that measurement quality determines the quality of the entire study. Even a well-developed theory and conceptual framework cannot produce meaningful results if the constructs are measured incorrectly.

Chapter Learning Objectives

After completing this chapter, readers should be able to:

1. Explain the concept of construct operationalization.
2. Distinguish between latent constructs and observed variables.
3. Differentiate reflective and formative measurement models.
4. Select or adapt validated measurement scales from the literature.
5. Develop high-quality questionnaire items.
6. Understand reliability and validity before data collection.
7. Design a complete measurement model ready for SmartPLS analysis.

3.1 From Theory to Measurement

Every quantitative research project begins with theory but ends with data. Measurement is the process that connects these two worlds.

3.1.1 Introduction

At the end of Chapter 2, the researcher had completed the conceptual design of the study. The research problem had been clearly defined, an appropriate scientific theory had been selected, the research constructs had been identified, a conceptual framework had been developed, and theory-based hypotheses had been formulated. Although this represents significant progress, the research is still not ready for empirical testing. Why?

Because statistical software such as SmartPLS cannot analyze theories, conceptual frameworks, or hypotheses directly. Instead, it analyzes data. Before data can be collected, every construct included in the conceptual framework must be translated into measurable variables. This transformation represents one of the most important stages of quantitative research and is known as *measurement*.

Many beginning researchers underestimate the importance of this stage. They often devote considerable effort to selecting a theory and developing hypotheses but spend relatively little time designing the measurement instrument. As a result, they may collect data that fail to represent the theoretical constructs accurately. No matter how sophisticated the statistical analysis becomes, poor measurement inevitably leads to poor research.

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For this reason, measurement should never be viewed as a technical activity performed after the research model has been completed. It is a theoretical process that requires the researcher to think carefully about what each construct means and how it can be observed indirectly through measurable indicators. The objective of this chapter is therefore to demonstrate how abstract theoretical ideas become measurable data suitable for empirical analysis.

3.1.2 Why Theories Cannot Be Measured Directly

Scientific theories are developed to explain phenomena that cannot usually be observed directly. Concepts such as trust, satisfaction, motivation, organizational commitment, information security awareness, digital competence, or artificial intelligence adoption describe ideas rather than physical objects. Consider the construct *Trust in Artificial Intelligence*. A researcher cannot observe trust in the same way that height, age, or income can be observed. Trust exists as an internal psychological state. It cannot be seen, touched, or measured directly.

Similarly, *Teaching Innovation* cannot be measured simply by looking at a lecturer. Some instructors may appear innovative while using traditional teaching methods, whereas others may quietly implement highly innovative practices without obvious external signs. Consequently, researchers must develop indirect methods of measuring these theoretical concepts.

Instead of measuring the construct itself, researchers measure observable behaviors, beliefs, perceptions, or attitudes that represent the construct. These observable measures are called *indicators*. The indicators are then transformed into questionnaire items that respondents answer during data collection. This process allows abstract concepts to become measurable. Scientific theories describe abstract concepts. Measurement transforms these concepts into observable data that can be analyzed statistically.

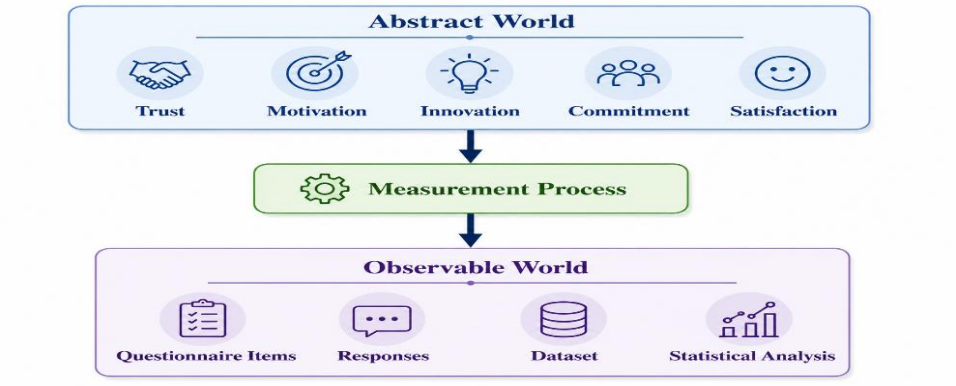

Figure 3.1: Abstract Constructs versus Observable Data

3.1.3 What Is Operationalization?

The process of transforming an abstract construct into measurable indicators is called *operationalization*. Operationalization answers one fundamental research question: *How will this construct be measured?*. Without operationalization, researchers know what they wish to study but have no systematic way of collecting evidence.

Suppose a researcher wishes to investigate *Digital Competence* among university instructors. The theoretical definition may state that digital competence refers to the knowledge, skills, and confidence required to use digital technologies effectively in teaching and learning. Although this definition explains the construct conceptually, it cannot yet be analyzed statistically. The

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researcher must therefore identify observable indicators that represent digital competence. Possible indicators include:

- Ability to use educational technologies.
- Confidence in applying digital tools.
- Ability to solve technology-related problems.
- Ability to integrate digital resources into teaching.

Each indicator can then be translated into questionnaire items such as:

- I feel confident using digital technologies during my teaching.
- I can solve most technology-related problems independently.
- I regularly integrate digital tools into my classroom activities.
- I am comfortable learning new educational technologies.

When respondents answer these questions, their responses become numerical data that represent the underlying construct. Operationalization therefore provides the essential bridge between theory and empirical research. It transforms theoretical concepts into measurable variables suitable for quantitative analysis.

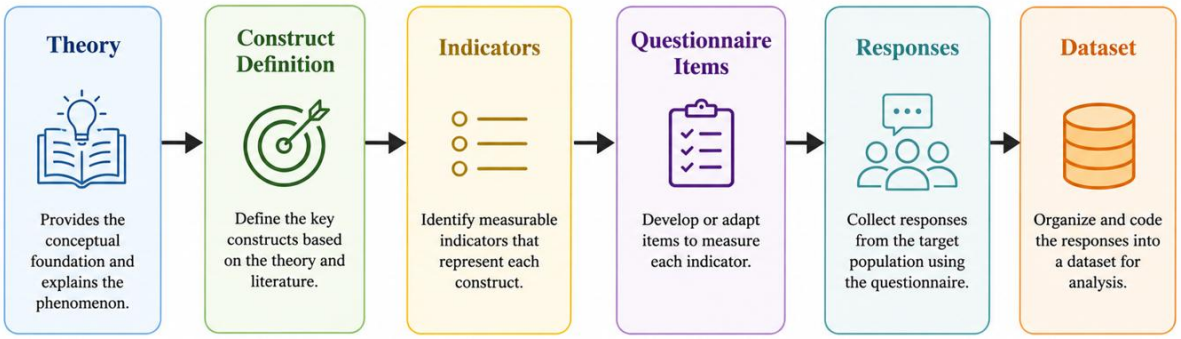
Theory
Provides the conceptual foundation and explains the phenomenon.
Construct Definition
Define the key constructs based on the theory and literature.
Indicators
Identify measurable indicators that represent each construct.
Questionnaire Items
Develop or adapt items to measure each indicator.
Responses
Collect responses from the target population using the questionnaire.
Dataset
Organize and code the responses into a dataset for analysis.

Figure 3.2: The Operationalization Process

3.1.4 The Measurement Chain

Measurement is best understood as a sequence of connected stages. Each stage depends on the quality of the previous stage. The process begins with scientific theory and ends with statistical analysis. The complete measurement chain can be summarized as follows:

Scientific Theory → Construct → Indicator → Questionnaire Item → Response → Data → Statistical Analysis

Each component plays a distinct role. The theory explains the phenomenon. The construct represents the theoretical concept. The indicators describe observable manifestations of the construct. The questionnaire items measure the indicators. Respondents provide answers. The answers become data. Finally, SmartPLS analyzes the relationships among the measured constructs.

If any stage of this chain is weak, the quality of the entire study is affected. For example, poorly written questionnaire items produce inaccurate responses. Inaccurate responses create poor-quality data. Poor-quality data reduce the accuracy of the statistical results and weaken the conclusions of the research. Measurement quality therefore determines research quality.

3.1.5 Running Case Study

Let us return to the running research project introduced in Chapters 1 and 2. One construct included in the conceptual framework is *Trust in AI*. The researcher first develops a conceptual definition. *Trust in AI refers to the degree to which university instructors believe*

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that artificial intelligence technologies are reliable, dependable, and suitable for supporting academic activities. The researcher then identifies indicators that represent this construct. Examples include:

- Confidence in AI.
- Reliability of AI outputs.
- Dependability of AI systems.
- Willingness to rely on AI technologies.

Finally, the indicators are translated into questionnaire items. Examples include:

- I trust AI tools to support my teaching activities.
- I believe AI systems provide reliable information.
- I feel confident using AI technologies in my academic work.
- AI technologies can be relied upon when completing teaching tasks.

Each item is measured using a five-point Likert scale ranging from *Strongly Disagree (1) to Strongly Agree (5).* The responses collected from university instructors become the observed data used to evaluate the theoretical model. Example illustrating how an abstract construct is transformed into measurable .

Table 3.1: Example of Construct Operationalization

Stage	*Example*
Theory	UTAUT
Construct	Trust in AI
Conceptual Definition	Belief that AI technologies are reliable and dependable
Indicators	Confidence, reliability, dependability
Questionnaire Item	"I trust AI tools to support my teaching activities."
Measurement Scale	Five-point Likert scale
Data	Numerical responses from participants

3.1.6 The Importance of Theory–Measurement Alignment

An important principle of quantitative research is that *measurement must remain faithful to theory.* Every questionnaire item should reflect the theoretical meaning of the construct it intends to measure. For example, if *Performance Expectancy* is defined as the degree to which AI improves teaching performance, then the questionnaire items should measure expected improvements in performance. An item such as: *I enjoy using AI.* does not measure performance expectancy. Instead, it measures enjoyment. A better item would be: *Using AI technologies improves my teaching performance.*

This item aligns directly with the theoretical definition of the construct. Maintaining consistency between theory and measurement ensures that the statistical analysis evaluates the intended theoretical relationships rather than unrelated concepts.

3.1.7 Looking Ahead

This section introduced the fundamental principle that theories cannot be analyzed directly. Researchers must first operationalize abstract constructs by developing measurable indicators and questionnaire items. Measurement therefore forms the bridge between conceptual thinking and empirical analysis.

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The next section examines the nature of *latent constructs and observed variables*, explaining why SmartPLS analyzes relationships among latent variables rather than individual questionnaire items and how multiple indicators are used to represent complex theoretical concepts.

The purpose of measurement is to transform abstract theoretical constructs into observable data suitable for empirical analysis. This transformation is achieved through operationalization, which links scientific theory, research constructs, indicators, questionnaire items, and respondent data. A strong measurement model begins with a strong theoretical foundation, ensuring that every questionnaire item accurately represents the construct it is intended to measure.

3.2 Latent Constructs and Observed Variables

A latent construct cannot be observed directly. Instead, it is represented by multiple observed variables collected through questionnaire items.

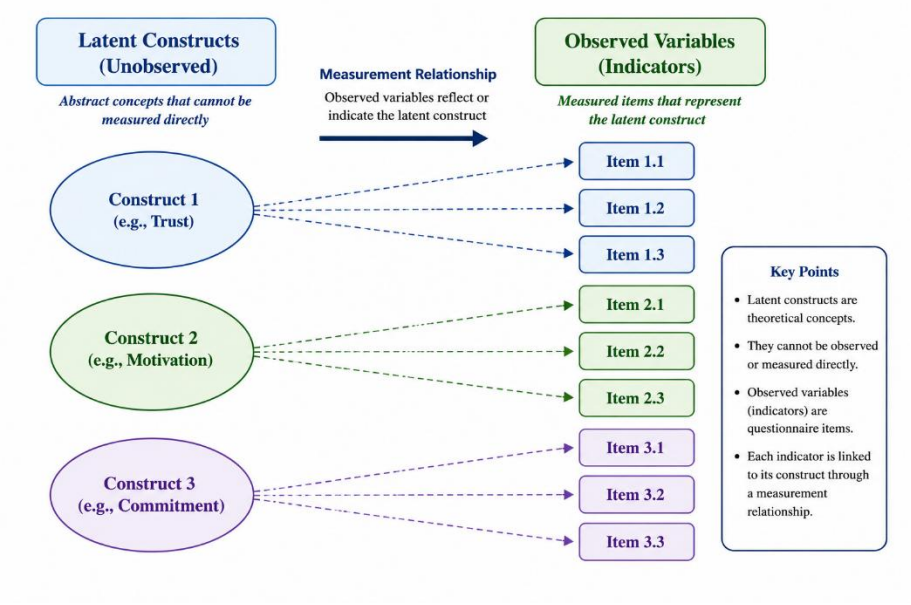
Latent Constructs (Unobserved)
Abstract concepts that cannot be measured directly
Measurement Relationship
Observed variables reflect or indicate the latent construct
Observed Variables (Indicators)
Measured items that represent the latent construct
Construct 1 (e.g., Trust)
Construct 2 (e.g., Motivation)
Construct 3 (e.g., Commitment)
Item 1.1
Item 1.2
Item 1.3
Item 2.1
Item 2.2
Item 2.3
Item 3.1
Item 3.2
Item 3.3
Key Points
Latent constructs are theoretical concepts.
They cannot be observed or measured directly.
Observed variables (indicators) are questionnaire items.
Each indicator is linked to its construct through a measurement relationship.

Figure 3.3: Latent Constructs and Observed Variables

3.2.1 Introduction

In the previous section, we learned that researchers cannot measure abstract concepts such as trust, satisfaction, or digital competence directly. Instead, these concepts must be operationalized using measurable indicators and questionnaire items. This naturally leads to another important question: *What exactly does SmartPLS analyze?*. Many beginning researchers believe that SmartPLS analyzes questionnaire items. Others assume it analyzes variables in the same way as traditional statistical software such as SPSS. Neither assumption is completely correct.

SmartPLS is designed to analyze *latent constructs* using information obtained from multiple *observed variables*. Understanding this distinction is essential because it forms the basis of Partial Least Squares Structural Equation Modeling (PLS-SEM). Before researchers can build a measurement model, they must clearly understand the difference between what is observed directly and what is inferred statistically.

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3.2.2 What Is a Latent Construct?

A *latent construct* is an abstract concept that cannot be observed or measured directly. It exists at the theoretical level and represents characteristics, perceptions, attitudes, beliefs, or behaviors that researchers seek to explain. Examples of latent constructs include:

- Trust
- Satisfaction
- Organizational Commitment
- Information Security Awareness
- Digital Competence
- Artificial Intelligence Adoption
- Teaching Innovation
- Behavioral Intention

Although these concepts are real, they cannot be observed directly. For example, a researcher cannot physically observe whether a lecturer trusts artificial intelligence. Instead, the researcher infers the level of trust from responses to carefully designed questionnaire items. For this reason, latent constructs are sometimes referred to as *unobservable variables* or *theoretical variables*. The purpose of measurement is to estimate these latent constructs using observable evidence.

3.2.3 What Is an Observed Variable?

An *observed variable* is a measurable piece of information collected directly from respondents. Observed variables are obtained through:

- Questionnaire items
- Survey responses
- Interview ratings
- Experimental measurements
- Recorded observations

Unlike latent constructs, observed variables can be measured directly. For example, Consider the questionnaire statement: *I trust AI tools to support my teaching activities***.** A respondent selects: **4 = Agree.** The number **4** becomes an observed variable. It represents one measurable response that contributes to estimating the latent construct *Trust in AI*. Observed variables therefore provide the evidence from which latent constructs are estimated. Respondents answer questionnaire items, producing observed data that SmartPLS uses to estimate the underlying latent construct.

3.2.4 Why Are Multiple Indicators Needed?

A common question asked by beginning researchers is: *Why can't one questionnaire item measure an entire construct?.* The answer lies in the complexity of human behavior. Most theoretical constructs represent broad concepts with multiple dimensions. For example, *Digital Competence* may include:

- Technical knowledge.
- Confidence in technology.
- Problem-solving ability.
- Ability to integrate technology into teaching.

One questionnaire item cannot adequately represent all these aspects. Using multiple indicators provides several advantages. First, it captures the construct more comprehensively. Second, it reduces the influence of random measurement error. Third, it increases the reliability of the measurement. Finally, it allows SmartPLS to estimate the latent construct more accurately. For

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these reasons, most latent constructs are measured using three or more indicators. A latent construct is normally represented by several indicators rather than a single measurement item.

3.2.5 Latent Constructs in SmartPLS

One of the defining characteristics of SmartPLS is that it estimates relationships among latent constructs rather than individual questionnaire items. Suppose a study investigates the following relationship: *Trust in AI → AI Adoption.* Neither Trust in AI nor AI Adoption is measured directly. Instead, each construct is represented by several observed variables.

SmartPLS first estimates the latent constructs using the observed indicators. Only after estimating the latent constructs does SmartPLS evaluate the structural relationship between them. This distinguishes PLS-SEM from many traditional statistical techniques, which often analyze observed variables directly. Understanding this distinction helps researchers appreciate why measurement quality is so important. If the observed variables fail to represent the latent construct accurately, the estimated relationships among constructs may also become inaccurate.

3.2.6 Running Case Study

Returning to the running case study, the researcher investigates *Artificial Intelligence Adoption among University Instructors.* One latent construct is *AI Adoption*. This construct cannot be measured directly. Instead, it is represented using several questionnaire items. Examples include:

- I regularly use AI tools in my teaching.
- I intend to increase my use of AI technologies.
- AI has become an important part of my teaching activities.
- I frequently rely on AI to support academic tasks.

Each questionnaire item produces an observed response. SmartPLS combines these responses to estimate the latent construct *AI Adoption*. The same process is repeated for every construct in the conceptual framework. Consequently, the final research model consists of relationships among latent constructs rather than relationships among individual questionnaire items. Each latent construct is estimated using multiple observed variables collected through questionnaire items

Table 3.2: Example of Latent Constructs and Observed Variables

Latent Construct	Example Observed Variables
Trust in AI	I trust AI tools for teaching.I believe AI provides reliable information.I feel confident using AI technologies.
Digital Competence	I can use educational technologies effectively.I solve digital problems independently.I quickly learn new technologies.
AI Adoption	I regularly use AI tools.I intend to continue using AI.AI is integrated into my teaching.

Latent constructs are abstract theoretical concepts that cannot be measured directly. They are estimated using multiple observed variables obtained from questionnaire items or other measurement instruments. SmartPLS uses these observed variables to estimate latent constructs and then evaluates the relationships among them. Understanding the distinction between latent constructs and observed variables is fundamental to developing a valid measurement model and conducting meaningful PLS-SEM analysis.

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3.3 Reflective and Formative Measurement Models

In reflective measurement, the construct causes the indicators. In formative measurement, the indicators form the construct.

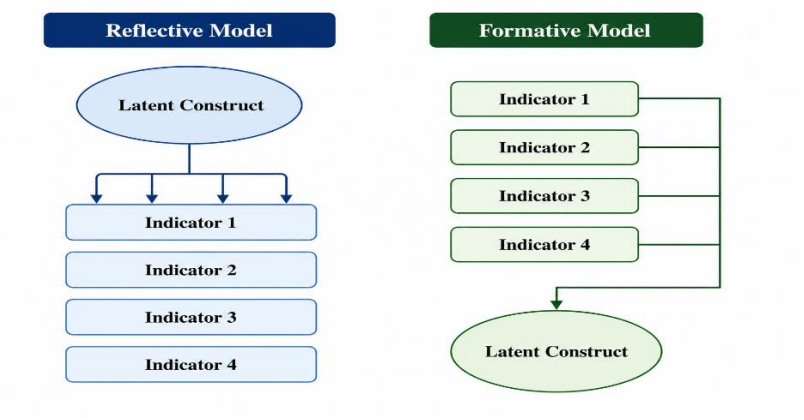

Figure 3.4: Two Approaches to Measurement

3.3.1 Introduction

One of the most important decisions in Structural Equation Modeling (SEM) is determining how a construct should be measured. Before researchers develop questionnaire items or collect data, they must decide whether each construct is *reflective* or *formative*. This decision is not based on personal preference or software settings. It is determined by the theoretical meaning of the construct.

Incorrectly specifying a formative construct as reflective—or a reflective construct as formative—can invalidate the measurement model and lead to incorrect conclusions. Therefore, researchers should understand the conceptual differences between these two approaches before beginning empirical analysis. This section explains the theoretical foundations of reflective and formative measurement models, their characteristics, practical examples, and a systematic procedure for selecting the appropriate model.

3.3.2 What Is a Reflective Measurement Model?

A *reflective measurement model* assumes that the latent construct causes the observed indicators. In other words, the construct exists first, and the indicators reflect that underlying construct. For example, consider the construct *Trust in AI*. If a university instructor has a high level of trust in artificial intelligence, that trust is expected to influence responses to several questionnaire items, such as:

- I trust AI tools to support my teaching.
- AI systems provide reliable information.
- I feel confident using AI technologies.
- AI technologies are dependable.

The responses to these items are expected to change because the underlying level of trust changes. The arrows therefore point from the construct toward the indicators. Reflective constructs are common in psychology, education, management, marketing, information systems, and social science research because many theoretical concepts represent attitudes, beliefs, perceptions, or intentions.

3.3.3 Characteristics of Reflective Indicators

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Reflective indicators possess several important characteristics. *The construct causes the indicators.* The indicators are consequences of the latent construct. *Indicators are expected to be correlated.* Because all indicators reflect the same underlying concept, respondents who agree with one indicator are likely to agree with the others. *Indicators are conceptually similar.*

Each indicator measures a different aspect of the same construct rather than a different concept. *Indicators are interchangeable***.** Removing one indicator usually does not change the conceptual meaning of the construct, provided that enough indicators remain. For example, if one Trust in AI item is removed, the construct still represents trust.

3.3.4 What Is a Formative Measurement Model?

A *formative measurement model* assumes the opposite direction of causality. Instead of the construct causing the indicators, the indicators combine to form the construct. Each indicator represents a unique component of the construct. Together, they define its meaning. Consider the construct *Socioeconomic Status*. This construct may consist of:

- Income.
- Education.
- Occupation.

These indicators do not reflect socioeconomic status. Instead, they create it. Removing one indicator changes the conceptual meaning of the construct. For example, measuring socioeconomic status without considering education produces a different concept from measuring it with education included. The arrows therefore point from the indicators toward the construct.

3.3.5 Characteristics of Formative Indicators

Formative indicators differ fundamentally from reflective indicators. Indicators form the construct. Each indicator contributes to defining the construct. Indicators are not required to be correlated. Income and education, for example, may not always increase together.

Indicators are not interchangeable. Removing an indicator changes the conceptual meaning of the construct. Each indicator captures a unique dimension. Every indicator contributes different information. Consequently, formative measurement focuses on capturing the complete definition of the construct rather than measuring repeated manifestations of the same concept.

3.3.6 Comparing Reflective and Formative Models

The differences between reflective and formative measurement models are summarized in Table 3.3. This comparison illustrates that the distinction is conceptual rather than statistical. Researchers should decide the measurement model before collecting data.

Table 3.3: Reflective versus Formative Measurement Models

Characteristic	*Reflective*	*Formative*
Direction of causality	Construct → Indicators	Indicators → Construct
Indicators represent	Effects of the construct	Components of the construct
Indicators expected to correlate	Yes	Not necessarily
Indicators interchangeable	Usually yes	No

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Characteristic	*Reflective*	*Formative*
Removing one indicator	Little conceptual change	Changes the construct definition
Typical examples	Satisfaction, Trust, Intention, Commitment	Socioeconomic Status, Service Quality Index, Organizational Resources

3.3.7 How Do Researchers Decide?

Many beginning researchers ask: *Should my construct be reflective or formative?.* The answer begins with theory. Researchers should ask the following questions. Question 1; Does the construct produce the indicators? If yes, the construct is probably reflective. Question 2; Do the indicators create the construct? If yes, the construct is probably formative. Question 3; If one indicator is removed, does the meaning of the construct change?. If no, the construct is likely reflective. If yes, the construct is likely formative. Question 4; Should the indicators be highly correlated?. If yes, reflective measurement is appropriate. If not, formative measurement may be more suitable. These questions provide a practical framework for selecting the appropriate measurement model.

3.3.8 Consequences of Misspecification

One of the most serious mistakes in SEM is specifying the wrong measurement model. Suppose a formative construct is modeled as reflective. The researcher may incorrectly delete indicators because they appear weak statistically, even though those indicators represent essential components of the construct. Conversely, if a reflective construct is modeled as formative, the estimated relationships may become unstable and difficult to interpret. Measurement model misspecification affects:

- Construct validity.
- Parameter estimates.
- Hypothesis testing.
- Interpretation of results.
- Scientific conclusions.

For this reason, researchers should determine the measurement model before collecting data and before opening SmartPLS.

3.3.9 Running Case Study

Returning to the AI adoption study, consider the construct Trust in AI. Theoretical reasoning suggests that trust exists before respondents answer the questionnaire. A lecturer who trusts AI is likely to agree with statements such as:

- I trust AI technologies.
- AI provides reliable information.
- AI systems are dependable.

These questionnaire items reflect the underlying level of trust. Therefore, *Trust in AI* should be modeled as a *reflective construct*. Now consider another construct: *Digital Infrastructure* at a university. Possible indicators include:

- Internet availability.
- Hardware resources.
- Software availability.
- Technical support.

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Together, these indicators define the level of digital infrastructure. Removing one of them changes the meaning of the construct. Consequently, Digital Infrastructure is better represented as a *formative construct*. This example illustrates why theory—not software—determines the appropriate measurement model.

Choosing between reflective and formative measurement models is a theoretical decision that should be made before data collection. Reflective models assume that the latent construct causes its indicators, whereas formative models assume that the indicators collectively define the construct. Correct specification is essential because measurement model misspecification can compromise the validity of the entire research study.

3.4 Developing Measurement Items

Measurement items are developed after defining the construct and identifying its indicators. Every questionnaire item should be supported by theory.

3.4.1 Introduction

After identifying the research constructs and deciding whether each construct should be measured reflectively or formatively, the researcher must develop the questionnaire items that will be used to collect data.

This stage is often underestimated by beginning researchers. Many believe that writing questionnaire items is simply a matter of creating a list of questions. In reality, questionnaire development is a scientific process that requires theoretical justification, careful wording, and attention to measurement quality.

Every measurement item should represent a specific aspect of the construct. Collectively, the items should provide a complete representation of the theoretical concept. If the items fail to represent the construct accurately, the data collected will not reflect the intended concept, regardless of the quality of the statistical analysis. The primary objective of measurement item development is therefore to ensure that each questionnaire item faithfully represents the theoretical construct it is intended to measure.

3.4.2 Sources of Measurement Items

Researchers generally obtain measurement items from one of three sources:

1. Adopting validated scales
2. Adapting existing scales
3. Developing new scales

The choice depends on the maturity of the research field, the availability of existing instruments, and the nature of the research problem.

Adopting Existing Scales; Whenever possible, researchers should adopt measurement items that have already been validated in previous studies. This approach offers several advantages. First, validated scales have usually undergone extensive testing in different contexts and populations. Second, adopting existing scales improves comparability between studies. Third, it strengthens the credibility of the measurement model because previous researchers have already demonstrated acceptable reliability and validity.

For example, constructs from the Technology Acceptance Model (TAM) or the Unified Theory of Acceptance and Use of Technology (UTAUT) have well-established measurement scales that have been used in hundreds of empirical studies. When adopting existing scales,

researchers should acknowledge the original source and maintain the conceptual meaning of the items.

Adapting Existing Scales; Sometimes an existing scale is conceptually appropriate but requires minor modifications to fit a different context. For example, an instrument originally developed for e-commerce may be adapted for artificial intelligence in higher education. Consider the original item: Using this system improves my job performance. This may be adapted as: *Using AI technologies improves my teaching performance.* The wording changes to reflect the new research context, while the theoretical meaning remains unchanged. Researchers should ensure that adapted items preserve the original construct definition and should explain any modifications made.

Developing New Measurement Items; Developing completely new measurement items should generally be considered only when suitable instruments do not exist. This situation may arise when:

- Investigating emerging technologies.
- Examining newly proposed theoretical constructs.
- Studying unique cultural or organizational contexts.

Developing new items requires a systematic process that includes:

- Reviewing the literature.
- Defining the construct conceptually.
- Identifying its dimensions.
- Writing multiple candidate items.
- Seeking expert review.
- Conducting pilot testing.

New measurement items should never be based solely on intuition or personal opinion.

3.4.3 Characteristics of Good Measurement Items

High-quality measurement items possess several important characteristics. *Clear***;** Items should use simple and precise language. Respondents should understand each statement without additional explanation. Poor example: Artificial intelligence provides multidimensional pedagogical optimization. Improved example: AI technologies improve my teaching effectiveness. *Specific;* Each item should measure only one idea. Poor example: AI is useful and easy to use. This item measures two different concepts. Improved examples: AI improves my teaching performance. AI is easy to use. *Relevant;* Every item should correspond directly to the theoretical definition of the construct. Items that measure unrelated concepts should not be included simply because they appear interesting. *Neutral;* Items should avoid leading respondents toward a particular answer. Poor example: Everyone agrees that AI improves education. Improved example: AI improves the quality of my teaching.

Appropriate for the Target Population; Questionnaire items should match the knowledge and experience of respondents. Technical language should be avoided unless respondents are expected to understand it.

3.4.4 Common Mistakes in Writing Measurement Items

Poorly written questionnaire items are a major source of measurement error. Some of the most common mistakes include: *Double-Barreled Items;* These items ask about two ideas simultaneously. Example: AI improves my teaching and reduces my workload. A respondent may agree with one statement but disagree with the other. Each concept should be measured separately.

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*Ambiguous Language***;** Avoid words such as: frequently, often, regularly, usually. unless they are clearly defined. Different respondents may interpret these terms differently. *Negative Wording;* Negative statements increase the likelihood of misunderstanding. Poor example: I do not disagree that AI is not useful. Simple positive wording is usually preferable. *Technical Terminology;* Avoid specialized terms that respondents may not understand. Replace technical expressions with clear and familiar language whenever possible.

Table 3.4: Examples of Poor and Improved Measurement Items

Poor Item	*Improved Item*
AI is useful and easy to use.	AI improves my teaching performance.AI is easy to use.
Everyone trusts AI.	I trust AI technologies.
AI usually helps me.	AI helps me complete teaching tasks more efficiently.
I do not disagree that AI is useful.	AI is useful in my teaching activities.

3.4.5 How Many Items Should Measure a Construct?

One of the most common questions asked by beginning researchers is: *How many questionnaire items should be used to measure each construct?*. There is no universal rule. However, several general guidelines are widely accepted. Most reflective constructs are measured using three to five indicators. Three indicators are usually considered the minimum required for stable estimation. Four or five indicators often provide a more comprehensive representation of the construct without making the questionnaire unnecessarily long. Researchers should avoid including large numbers of highly similar items simply to increase reliability. Quality is more important than quantity. Each item should contribute meaningful information about the construct.

3.4.6 Running Case Study

Returning to the AI adoption study, the researcher wishes to measure *Performance Expectancy.* The literature identifies validated items from UTAUT that can be adapted for the higher education context. The construct is defined as: *The degree to which university instructors believe that using AI technologies improves their teaching performance***.** The following measurement items are developed. PE1: AI technologies improve my teaching performance.
PE2: AI technologies increase my teaching productivity. PE3: AI technologies enable me to complete teaching tasks more efficiently. PE4: AI technologies enhance the overall quality of my teaching.
Each item reflects the theoretical definition of the construct and measures one specific aspect of expected performance improvement. The researcher uses a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5).

Table 3.5: Example of Measurement Item Development

Construct	*Performance Expectancy*
Definition	Belief that AI improves teaching performance
Source	Adapted from UTAUT
Measurement Model	Reflective
Number of Items	Four
Response Scale	Five-point Likert scale

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3.4.7 Best Practices for Measurement Item Development

Before finalizing a questionnaire, researchers should review every measurement item carefully. Ask the following questions:

- Does the item reflect the theoretical definition of the construct?
- Is the wording clear and unambiguous?
- Does the item measure only one concept?
- Is the language appropriate for respondents?
- Has the item been adopted or adapted from a validated source whenever possible?
- Is the response scale appropriate?

A careful review before pilot testing can eliminate many potential measurement problems. Measurement items transform theoretical constructs into observable data. High-quality items are theory-driven, clearly written, specific, and appropriate for the target population. Researchers should adopt or adapt validated measurement scales whenever possible and develop new items only when suitable instruments are unavailable. Careful measurement item development strengthens the validity and reliability of the entire research project.

3.5 Questionnaire Design

A well-designed questionnaire follows a logical structure that guides respondents smoothly from the introduction to the final question.

3.5.1 Introduction

After developing high-quality measurement items, the next step is to organize those items into a complete research questionnaire. The questionnaire is the primary instrument used to collect data in most quantitative studies employing SmartPLS. It represents the final stage of measurement design before pilot testing and data collection.

Many beginning researchers believe that a questionnaire is simply a list of questions. In reality, an effective questionnaire is a carefully designed scientific instrument. It should encourage respondents to participate, minimize misunderstanding, reduce measurement error, and produce reliable and valid data.

A poorly designed questionnaire may discourage respondents, increase missing data, create response bias, and ultimately weaken the quality of the research findings. Therefore, questionnaire design deserves the same level of attention as theory selection, conceptual framework development, and hypothesis formulation.

The objective of this section is to explain how researchers can design questionnaires that are clear, professional, and suitable for empirical research using SmartPLS.

3.5.2 Components of a Research Questionnaire

A professional research questionnaire normally consists of five main sections. *Cover Page;*The cover page provides essential information about the study. It should include:

- Research title.
- Researcher's name and affiliation.
- Purpose of the study.
- Estimated completion time.
- Statement of voluntary participation.
- Confidentiality assurance.

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- Contact information.

The cover page should be brief, professional, and easy to understand.

Introduction and Informed Consent; Before answering any questions, respondents should understand the purpose of the study and how their information will be used. A typical introduction explains:

- Why the research is being conducted.
- Why the respondent has been invited.
- That participation is voluntary.
- That responses will remain confidential.
- That respondents may withdraw at any time.

For online surveys, researchers often include a statement such as: *By continuing with this questionnaire, you indicate your voluntary consent to participate in this research.* Researchers should also ensure that their study complies with institutional ethical guidelines and approval requirements.

Demographic Information; The next section collects background information about respondents. Common demographic variables include:

- Age.
- Gender.
- Educational qualification.
- Years of experience.
- Job position.
- Organization.
- Academic discipline.

Researchers should collect only information that is relevant to the research objectives. Unnecessary personal questions should be avoided.

Measurement Items; This section contains the questionnaire items developed in the previous section. Items should be grouped according to constructs rather than presented randomly. For example:

- Performance Expectancy.
- Effort Expectancy.
- Social Influence.
- Facilitating Conditions.
- Trust in AI.
- Digital Competence.
- AI Adoption.
- Teaching Innovation.

Grouping related items improves questionnaire organization and reduces respondent confusion.

Closing Statement; The questionnaire should conclude with a brief message thanking respondents for their participation. For example: *Thank you for taking the time to complete this questionnaire. Your participation is greatly appreciated and will contribute to improving our understanding of artificial intelligence adoption in higher education. A polite closing statement leaves respondents with a positive impression of the research.*

3.5.3 Selecting an Appropriate Response Scale

A response scale determines how respondents express their opinions or experiences. The most widely used scale in SmartPLS research is the *Likert scale*. Although both are acceptable, five-point and seven-point Likert scales are the most common because they are easy for respondents

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to understand and provide sufficient variation for statistical analysis. Researchers should use the same response scale throughout the questionnaire whenever possible. Changing scales between sections may confuse respondents and increase measurement error.

Table 3.6: Common Response Scales

Scale	Typical Use
Five-point Likert	Most social science and management research
Seven-point Likert	Greater measurement sensitivity
Frequency Scale	Never to Always
Agreement Scale	Strongly Disagree to Strongly Agree
Importance Scale	Not Important to Extremely Important

3.5.4 Organizing Questionnaire Items

The order of questionnaire items influences both respondent engagement and data quality. Researchers should follow several general principles. *Begin with Simple Questions;* Easy questions help respondents become familiar with the questionnaire. Complex or sensitive questions should not appear at the beginning.

Group Similar Items Together; Items measuring the same construct should generally appear together. This improves logical flow and reduces cognitive effort.

Separate Different Constructs Clearly; Transitions between constructs should be obvious. Researchers may use headings or brief instructions when appropriate.

Place Sensitive Questions Near the End; Questions involving income, salary, or other personal information should appear after respondents have become comfortable with the questionnaire.

Keep the Questionnaire Manageable; Long questionnaires increase respondent fatigue and reduce completion rates. Researchers should include only items that contribute directly to measuring the research constructs.

3.5.5 Online versus Paper Questionnaires

Modern research increasingly relies on online questionnaires because they are convenient, economical, and easy to distribute. Common platforms include:

- Google Forms.
- Microsoft Forms.
- Qualtrics.
- SurveyMonkey.

Online questionnaires provide several advantages. They reduce printing costs, automate data entry, minimize transcription errors, and facilitate data export for statistical analysis. However, online surveys also present challenges. Researchers have less control over the survey environment, and respondents may abandon the questionnaire before completion. Paper questionnaires remain useful when internet access is limited or when researchers conduct face-to-face data collection. The choice should depend on the characteristics of the target population.

3.5.6 Common Questionnaire Design Mistakes

Several common mistakes reduce questionnaire quality. *Excessive Length;* Very long questionnaires discourage participation and increase incomplete responses. Researchers should

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balance comprehensive measurement with respondent burden. Inconsistent Response Scales**;** Switching repeatedly between different scales creates confusion. A consistent scale improves response quality.

Poor Layout; Crowded pages, inconsistent formatting, or unclear instructions make questionnaires difficult to complete. A clean and professional layout improves readability. *Sensitive Questions at the Beginning*; Early personal questions may reduce respondents' willingness to continue. General questions should appear first. *Collecting Unnecessary Information*; Every question should have a clear purpose. If a question does not contribute to the research objectives, it should be removed.

3.5.7 Running Case Study

The AI adoption study is now ready for questionnaire development. The questionnaire is organized into five sections. Section A: Introduction and informed consent. Section B: Demographic information, including age, gender, academic rank, teaching experience, and faculty. Section C: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Section D: Trust in AI and Digital Competence. Section E: AI Adoption and Teaching Innovation. All construct items use the same five-point Likert scale. The estimated completion time is approximately ten minutes, making the questionnaire practical for busy university instructors.

Table 3.7: Example Questionnaire Structure for the Running Case Study

Section	*Content*
A	Introduction and informed consent
B	Demographic information
C	UTAUT constructs
D	Trust in AI and Digital Competence
E	AI Adoption and Teaching Innovation

3.5.8 Preparing for Pilot Testing

Before distributing the questionnaire to the target population, researchers should conduct a final review. The questionnaire should be checked for:

- Spelling and grammar.
- Clarity of wording.
- Consistency of response scales.
- Logical organization.
- Completeness of instructions.
- Formatting and visual appearance.

Once this review is complete, the questionnaire is ready for expert evaluation and pilot testing, which are discussed in the next section. A well-designed questionnaire is essential for collecting reliable and valid data. It should follow a logical structure, use clear and concise language, employ consistent response scales, and comply with ethical research principles. Careful questionnaire design reduces measurement error, improves respondent engagement, and provides high-quality data for SmartPLS analysis.

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3.6 Ensuring Measurement Quality Before Data Collection

Measurement quality should be established before collecting the main dataset. A carefully designed instrument reduces measurement error and improves the credibility of the research findings.

3.6.1 Introduction

Developing measurement items and organizing them into a professional questionnaire are important achievements. However, researchers should not distribute the questionnaire immediately after completing its design. Before collecting data, researchers must evaluate whether the questionnaire actually measures the intended constructs accurately and consistently. This process is known as ensuring measurement quality.

Many beginning researchers mistakenly believe that reliability and validity are evaluated only after importing data into SmartPLS. Although statistical assessment is an essential part of the analysis process, measurement quality begins much earlier. Researchers should first ensure that the questionnaire represents the theoretical constructs appropriately, is understandable to respondents, and functions effectively under realistic conditions. Investing time in evaluating the questionnaire before data collection helps prevent costly mistakes that cannot easily be corrected once responses have been collected.

3.6.2 Reliability and Validity: The Basic Concepts

Two concepts dominate the discussion of measurement quality:

- Reliability
- Validity

Although these concepts are closely related, they address different questions. Reliability asks: *Does the instrument measure consistently?*. If respondents with similar characteristics answer the questionnaire under similar conditions, the measurement should produce consistent results. Validity asks: *Does the instrument measure what it is intended to measure?*. A questionnaire may produce highly consistent responses but still fail to measure the intended construct.

For example, imagine a questionnaire designed to measure *Digital Competence*. If the items actually measure respondents' confidence rather than their competence, the questionnaire may be reliable but not valid. Therefore, researchers must consider both reliability and validity when designing measurement instruments. At this stage, the objective is to understand these concepts conceptually. Their statistical evaluation using SmartPLS will be discussed in Chapter 4. A high-quality measurement instrument should be both reliable and valid. One characteristic cannot compensate for the absence of the other.

3.6.3 Content Validity

Content validity refers to the extent to which the measurement items adequately represent the entire meaning of the construct. Researchers should ask: *Do these items fully capture the theoretical concept?*. For example, suppose *Teaching Innovation* is defined as using creative instructional methods, integrating educational technologies, designing engaging learning activities, and encouraging active student participation. If the questionnaire measures only technology use while ignoring the remaining aspects, the construct is only partially represented. Strong content validity requires researchers to:

- Review the theoretical literature carefully.
- Define constructs clearly.

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- Identify all important dimensions.
- Ensure that measurement items cover the complete conceptual domain.

Content validity is established primarily through theoretical reasoning and expert evaluation rather than statistical analysis.

3.6.4 Face Validity

Face validity concerns whether the questionnaire appears appropriate to those who read it. Unlike content validity, face validity focuses on the clarity and apparent relevance of the items. Typical questions include:

- Are the items easy to understand?
- Does the wording appear appropriate?
- Would respondents interpret the items as intended?
- Does the questionnaire appear professional?

Although face validity is considered the simplest form of validity, it plays an important role in improving respondent confidence and reducing misunderstandings. A questionnaire that appears confusing or poorly organized may discourage respondents even if its theoretical foundations are strong.

Theory → Content Validity →Face Validity → Pilot Testing →Final Questionnaire

Measurement quality is established through several complementary activities before large-scale data collection begins.

3.6.5 Expert Review

One of the most effective methods for improving questionnaire quality is expert review. Researchers should invite individuals with expertise in the research topic, research methodology, or questionnaire design to evaluate the instrument. Experts typically examine:

- Theoretical consistency.
- Construct definitions.
- Relevance of measurement items.
- Clarity of wording.
- Completeness of construct coverage.
- Overall questionnaire organization.

Experts may recommend:

- Removing unnecessary items.
- Revising ambiguous wording.
- Adding missing indicators.
- Improving instructions.

Researchers should document major revisions made following expert feedback because this strengthens the methodological transparency of the study.

3.6.6 Pilot Testing

After expert review, researchers should conduct a *pilot study*. A pilot study is a small-scale trial of the questionnaire carried out before the main data collection. The objective is not to test hypotheses but to evaluate whether the questionnaire functions as intended. Pilot participants

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should resemble the target population as closely as possible. During pilot testing, researchers evaluate:

- Whether respondents understand the questions.
- Whether instructions are clear.
- Whether any items are confusing.
- The time required to complete the questionnaire.
- Whether technical problems occur in online surveys.

Based on the pilot results, researchers may revise or remove problematic items before distributing the final questionnaire. Conducting a pilot study greatly reduces the likelihood of measurement problems during the main study.

3.6.7 Common Mistakes Before Data Collection

Several common mistakes reduce measurement quality. Skipping Expert Review, some researchers distribute questionnaires without obtaining independent feedback. This increases the likelihood of unclear wording and incomplete construct coverage. Ignoring Pilot Testing, Minor problems discovered during pilot testing can become major problems during the main study. Pilot testing should therefore be considered an essential part of questionnaire development. Revising Constructs Without Theory, Researchers should not modify constructs simply because reviewers suggest additional questions. Any modification must remain consistent with the theoretical definition of the construct. Collecting Data Too Early, Researchers are often eager to begin data collection. However, collecting poor-quality data quickly is far less valuable than collecting high-quality data after careful preparation.

3.6.8 Running Case Study

The AI adoption questionnaire is now reviewed by three experts:

- One specialist in educational technology.
- One researcher experienced in PLS-SEM.
- One university instructor with expertise in artificial intelligence.

The experts recommend several improvements.

- Simplify technical terminology.
- Separate two double-barreled questionnaire items.
- Improve the wording of one Digital Competence item.
- Clarify the questionnaire instructions.

After incorporating these recommendations, the researcher conducts a pilot study with 30 university instructors. Participants report that the questionnaire requires approximately nine minutes to complete and that the instructions are clear. Minor wording changes are made before launching the main survey. At this point, the questionnaire is considered ready for large-scale data collection. Measurement quality begins long before statistical analysis. Researchers should establish strong theoretical foundations, ensure content and face validity, obtain expert feedback, and conduct pilot testing before collecting the main dataset. Careful preparation at this stage minimizes measurement error and provides a solid foundation for the statistical evaluation of reliability and validity in Chapter 4.

3.7 Preparing the Measurement Model for SmartPLS

The measurement model is completed before statistical analysis begins. Careful preparation ensures that SmartPLS receives well-structured and meaningful data.

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3.7.1 Introduction

At this stage of the research process, the researcher has completed nearly all aspects of measurement design. The constructs have been identified, the appropriate measurement models have been selected, questionnaire items have been developed, the questionnaire has been reviewed by experts, and pilot testing has been completed. The final task before collecting the main dataset is to prepare the measurement model for SmartPLS.

Many beginning researchers believe that this preparation begins after data collection. In reality, SmartPLS analysis starts much earlier. Researchers should organize their measurement model before distributing the questionnaire so that every construct, indicator, and questionnaire item corresponds precisely to the conceptual framework developed in Chapter 2. Careful preparation reduces errors during data collection and simplifies the later stages of SmartPLS analysis.

3.7.2 Organizing Constructs and Indicators

Each construct included in the conceptual framework should be linked clearly to its corresponding indicators. Researchers should prepare a measurement table similar to the one shown below.

Table 3.9: Example Measurement Model Specification

Construct	*Indicator Code*	*Example Measurement Item*
Performance Expectancy	PE1	AI improves my teaching performance.
	PE2	AI increases my teaching productivity.
	PE3	AI helps me complete teaching tasks efficiently.
Trust in AI	TAI1	I trust AI tools in my teaching.
	TAI2	AI provides reliable information.
	TAI3	AI technologies are dependable.
AI Adoption	AIA1	I regularly use AI in my teaching.
	AIA2	I intend to continue using AI technologies.
	AIA3	AI has become part of my teaching activities.

Preparing this table before data collection helps researchers organize the measurement model systematically and minimizes confusion during data analysis.

3.7.3 Coding Measurement Items

Each questionnaire item should receive a unique code. A simple coding system improves data management and simplifies SmartPLS model construction. Examples include:

- PE1, PE2, PE3 (Performance Expectancy)
- EE1, EE2, EE3 (Effort Expectancy)
- SI1, SI2, SI3 (Social Influence)
- FC1, FC2, FC3 (Facilitating Conditions)
- TAI1, TAI2, TAI3 (Trust in AI)
- DC1, DC2, DC3 (Digital Competence)
- AIA1, AIA2, AIA3 (AI Adoption)
- TI1, TI2, TI3 (Teaching Innovation)

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Researchers should use consistent coding throughout the questionnaire, dataset, SmartPLS project, tables, and research report. Changing codes during the research process often leads to unnecessary errors.

3.7.4 Organizing the Dataset

Before importing data into SmartPLS, researchers should plan the structure of the dataset. Each row should represent one respondent. Each column should represent one observed variable. This simple structure allows SmartPLS to recognize each indicator correctly during model specification. Researchers should avoid merged cells, inconsistent coding, or unnecessary formatting within the dataset. A clean spreadsheet saves considerable time during analysis.

3.7.5 Reverse-Coded Items

Some questionnaires include negatively worded items. For example: *I do not trust AI technologies.* If the response scale ranges from 1 (Strongly Disagree) to 5 (Strongly Agree), higher scores indicate lower trust. Before statistical analysis, these responses must be *reverse coded* so that all indicators measure the construct in the same direction. Researchers should keep reverse-coded items to a minimum because they may confuse respondents and increase measurement error. Whenever possible, positively worded items are preferable.

3.7.6 Final Checklist Before Data Collection

Before launching the main survey, researchers should verify that the measurement model is complete. The following checklist provides a useful guide.

✓ Every construct has a clear conceptual definition.

✓ Every construct has the correct measurement model (reflective or formative).

✓ Measurement items are theoretically justified.

✓ Questionnaire items are coded consistently.

✓ Response scales are consistent.

✓ Expert review has been completed.

✓ Pilot testing has been completed.

✓ Questionnaire revisions have been finalized.

✓ Dataset structure has been planned.

✓ Ethical approval has been obtained where required.

Completing this checklist greatly reduces the likelihood of problems during data collection and analysis. Researchers should complete all preparation steps before beginning large-scale data collection.

3.7.7 Running Case Study

The AI adoption study is now fully prepared for empirical investigation. The researcher has completed the following tasks:

- Selected UTAUT as the theoretical foundation.
- Extended the model by including Trust in AI and Digital Competence.
- Identified all research constructs.
- Determined that the constructs are reflective.
- Adopted and adapted validated measurement items.
- Designed a structured questionnaire.
- Obtained expert feedback.
- Conducted a pilot study.
- Assigned consistent indicator codes.

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- Planned the dataset for SmartPLS.

The study is now ready for the next stage: collecting data from university instructors. No statistical analysis has yet been performed. However, the measurement model has been prepared carefully, ensuring that the data collected will represent the theoretical constructs accurately.

3.7.8 Transition to Chapter 4

The completion of the measurement model marks an important milestone in the research process.

The researcher now possesses:

- A theory-driven conceptual framework.
- Clearly defined constructs.
- Well-designed measurement items.
- A professional questionnaire.
- A structured dataset ready for analysis.

The next question naturally follows: *How can researchers evaluate whether the measurement model actually performs well after collecting data?*

This question introduces *Chapter 4*, where readers will learn how to use SmartPLS to evaluate measurement quality, assess reliability and validity statistically, estimate the structural model, and interpret the results.

Preparing the measurement model is the final stage before empirical data collection. A well-prepared measurement model includes clearly defined constructs, appropriate indicators, consistent coding, a professional questionnaire, expert review, pilot testing, and a structured dataset. Careful preparation minimizes errors, improves data quality, and provides a solid foundation for successful SmartPLS analysis in Chapter 4.

3.8 Chapter Summary

Chapter 3 explained how theoretical constructs are transformed into measurable variables suitable for empirical analysis using SmartPLS. It emphasized that theories cannot be analyzed directly; instead, researchers must develop a rigorous measurement model that accurately operationalizes abstract constructs into observable indicators. The chapter introduced the relationship between theory and measurement, distinguished latent constructs from observed variables, and highlighted the importance of operationalization as the bridge between conceptual thinking and empirical research.

A major focus was the distinction between reflective and formative measurement models, emphasizing that this choice should be guided by theory rather than statistical considerations. The chapter also presented practical approaches to developing measurement items, including adopting, adapting, or creating scales, while stressing the value of using validated instruments whenever possible. Guidance was provided on designing professional questionnaires, selecting appropriate response scales, and organizing survey instruments to enhance data quality.

To ensure measurement quality, the chapter discussed expert review, content and face validity, pilot testing, and careful questionnaire refinement before data collection. Finally, it outlined the practical steps required to prepare the measurement model for SmartPLS, including indicator coding, dataset preparation, and readiness checks.

Using the running case study on Artificial Intelligence Adoption in Higher Education, the chapter demonstrated how theoretical constructs were systematically translated into measurable variables. By the end of the chapter, readers had developed a complete measurement model aligned with the conceptual framework, establishing a solid foundation for data collection and statistical analysis. The next chapter builds on this foundation by introducing SmartPLS and demonstrating how to evaluate measurement models and test theory-driven hypotheses.

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3.9 Running Case Study: Continuing the AI Adoption Research Project: Developing the Measurement Instrument

Purpose of the Case Study: In Chapter 3, the focus shifts from conceptualization to measurement. The researcher must now answer an important methodological question: How can abstract theoretical constructs such as Trust in AI or Digital Competence be measured accurately?. This chapter demonstrates how the conceptual framework developed in Chapter 2 becomes a complete measurement model ready for empirical data collection.

*Step 1: Reviewing the Conceptual Framework***;** The conceptual framework developed in Chapter 2. Before collecting data, every construct in this framework must be transformed into measurable variables.

Step 2: Defining the Constructs
The researcher begins by preparing clear conceptual definitions for each construct.

Construct	*Conceptual Definition*
Performance Expectancy	The degree to which instructors believe that AI improves their teaching performance.
Effort Expectancy	The degree to which AI technologies are perceived as easy to learn and use.
Social Influence	The extent to which important colleagues and administrators encourage AI use.
Facilitating Conditions	The availability of institutional resources and support for AI use.
Trust in AI	The belief that AI technologies are reliable, dependable, and trustworthy.
Digital Competence	The knowledge and skills required to use digital technologies effectively.
AI Adoption	The extent to which instructors currently use or intend to use AI technologies.
Teaching Innovation	The use of creative teaching practices supported by AI technologies.

These definitions ensure that every construct has a clear theoretical meaning before measurement begins.

Step 3: Selecting the Measurement Model
The researcher now determines whether each construct should be measured reflectively or formatively. Using the theoretical reasoning introduced earlier in this chapter, the researcher concludes that every construct in the proposed model is *reflective*.
Why?. Because the constructs represent attitudes, perceptions, beliefs, or behavioral intentions. Changes in the underlying construct are expected to produce corresponding changes in the questionnaire responses. The measurement model is therefore specified as follows.

Construct	*Measurement Model*
Performance Expectancy	Reflective
Effort Expectancy	Reflective
Social Influence	Reflective
Facilitating Conditions	Reflective
Trust in AI	Reflective
Digital Competence	Reflective
AI Adoption	Reflective

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Construct	*Measurement Model*
Teaching Innovation	Reflective

Step 4: Selecting Measurement Items

Rather than creating completely new questionnaire items, the researcher reviews previous literature. Validated scales are identified from studies based on UTAUT and related AI adoption research. Some items are adopted directly, while others are adapted slightly to fit the higher education context. Examples include:

Performance Expectancy

PE1: AI technologies improve my teaching performance.
PE2: AI technologies increase my teaching productivity.
PE3: AI technologies enable me to complete teaching tasks more efficiently.
PE4: AI technologies enhance the quality of my teaching.

Trust in AI

TAI1: I trust AI technologies when performing teaching activities.
TAI2: AI systems provide reliable information.
TAI3: AI technologies are dependable.
TAI4: I feel confident relying on AI in my academic work.

AI Adoption

AIA1: I regularly use AI technologies in my teaching.
AIA2: I intend to increase my use of AI technologies.
AIA3: AI has become an important part of my teaching activities.
AIA4: I recommend AI technologies to other instructors.

Each item corresponds directly to the theoretical definition of the construct.

Step 5: Choosing the Response Scale

To ensure consistency throughout the questionnaire, the researcher selects a *five-point Likert scale.*

Response	*Score*
Strongly Disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly Agree	5

The same response scale is used for every construct. Maintaining a consistent response format simplifies questionnaire completion and facilitates subsequent statistical analysis.

Step 6: Designing the Questionnaire

The questionnaire is organized into five sections.

Section	*Content*
A	Introduction and informed consent
B	Demographic information
C	UTAUT constructs (PE, EE, SI, FC)
D	Trust in AI and Digital Competence
E	AI Adoption and Teaching Innovation

The estimated completion time is approximately 10 minutes, making the questionnaire practical for busy university instructors.

Step 7: Coding the Measurement Items

Each questionnaire item receives a unique identifier.

Construct	*Coding Example*
Performance Expectancy	PE1–PE4

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Construct	*Coding Example*
Effort Expectancy	EE1–EE4
Social Influence	SI1–SI4
Facilitating Conditions	FC1–FC4
Trust in AI	TAI1–TAI4
Digital Competence	DC1–DC4
AI Adoption	AIA1–AIA4
Teaching Innovation	TI1–TI4

This coding system will later be used in the dataset, SmartPLS project, statistical tables, and research report.

Step 8: Expert Review

Before distributing the questionnaire, the researcher requests feedback from three experts.

The review panel consists of:

- A specialist in Artificial Intelligence in Education.
- A researcher experienced in PLS-SEM.
- A senior university instructor with expertise in educational technology.

The experts evaluate:

- Construct definitions.
- Measurement items.
- Questionnaire organization.
- Clarity of language.
- Theoretical consistency.

Based on their recommendations:

- Two questionnaire items are simplified.
- One double-barreled statement is divided into two separate items.
- Minor wording changes improve clarity.

No constructs are removed because all remain theoretically justified.

Step 9: Pilot Testing

The revised questionnaire is administered to *30 university instructors* representing the target population.

The pilot study examines:

- Clarity of instructions.
- Ease of understanding.
- Completion time.
- Question sequencing.
- Overall respondent experience.

Results indicate:

- Average completion time: 9 minutes.
- All items are easily understood.
- No major wording problems are identified.
- Respondents recommend only minor formatting improvements.

After implementing these suggestions, the questionnaire is finalized.

Step 10: Preparing for SmartPLS

The researcher now prepares the measurement model for empirical analysis.

The following tasks have been completed.

✓ Construct definitions finalized.

✓ Reflective measurement model specified.

✓ Validated measurement items adopted or adapted.

✓ Five-point Likert scale selected.

✓ Questionnaire professionally designed.

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✓ Indicator coding completed.
✓ Expert review completed.
✓ Pilot study completed.
✓ Final questionnaire approved.
At this stage, no statistical analysis has been conducted.
However, the study now possesses a complete measurement instrument that accurately represents the theoretical framework developed in Chapter 2.

3.10 Analytical Review & Critical Inquiry
Before moving forward, pause to evaluate the core assumptions and structural relationships introduced in this chapter.

📖 A researcher develops excellent hypotheses but poor questionnaire items. Discuss how this may affect the final SmartPLS results.

📖 Another researcher selects measurement items without reviewing previous literature. Critically evaluate this approach.

📖 Can a questionnaire have high reliability but poor validity? Explain your answer with an example.

📖 Some researchers argue that longer questionnaires always produce better measurement.Do you agree? Justify your answer.

📖 Should negatively worded (reverse-coded) items always be included in questionnaires? Discuss both advantages and disadvantages.

📖 Why is measurement design considered one of the most important stages of quantitative research?

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Chapter 4
Analyzing Data Using SmartPLS

*Chapter Purpose***:** After designing a theory-driven measurement model and collecting data, researchers must evaluate whether the data support their theoretical model. This chapter introduces SmartPLS as a tool for estimating Partial Least Squares Structural Equation Models (PLS-SEM). Readers will learn how to build the model, evaluate the measurement model, assess the structural model, test hypotheses, and interpret results according to international publication standards. Unlike software manuals that focus on clicking menus, this chapter emphasizes theoretical interpretation, research decision-making, and scientific reporting.

Chapter Learning Objectives

After completing this chapter, readers should be able to:

1. Understand the SmartPLS workflow from data import to interpretation.
2. Build a measurement and structural model in SmartPLS.
3. Evaluate reflective and formative measurement models.
4. Assess reliability and validity using accepted PLS-SEM criteria.
5. Evaluate the structural model.
6. Test direct, mediating, moderating, and higher-order relationships.
7. Interpret SmartPLS output correctly.
8. Report statistical results according to APA 7 and international journal standards.

Introduction

The chapter follows the same theory-driven philosophy established throughout this book. Every statistical procedure is introduced within its theoretical context. Readers will first learn how a conceptual framework is translated into a SmartPLS model, followed by systematic evaluation of the measurement model and the structural model. Rather than treating statistical analysis as an isolated technical exercise, the chapter demonstrates how each analytical decision contributes to answering the original research questions and testing the proposed hypotheses.

Special attention is given to interpreting statistical evidence correctly. Researchers frequently report numerous statistical values without explaining their scientific meaning. Numbers such as factor loadings, Composite Reliability, Average Variance Extracted (AVE), Heterotrait–Monotrait Ratio (HTMT), path coefficients, coefficients of determination (R^2), effect sizes (f^2), predictive relevance (Q^2), and bootstrapping significance tests are valuable only when they are interpreted within the context of the underlying theory. Throughout this chapter, readers will therefore learn not only how these statistics are evaluated but also what they reveal about the adequacy of the proposed theoretical model.

Another distinguishing feature of this chapter is its emphasis on research decision-making rather than software operation. Statistical analysis requires numerous decisions regarding indicator retention, construct specification, hypothesis evaluation, and model interpretation. These decisions should never be based solely on numerical thresholds. Instead, they should be guided by theoretical reasoning, previous literature, and sound methodological principles. This

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perspective reflects the central philosophy of this book: theory should always guide statistical analysis—not the other way around.

The running case study introduced in the previous chapters continues throughout this chapter. Using the Artificial Intelligence Adoption in Higher Education project, readers will build the SmartPLS model, evaluate measurement quality, assess structural relationships, test the proposed hypotheses, and interpret the findings from both statistical and theoretical perspectives. By following one complete research project from its initial idea to empirical analysis, readers will gain a comprehensive understanding of how SmartPLS supports theory-driven research in practice.

It is equally important to recognize that statistical significance alone does not constitute scientific contribution. A statistically significant relationship is meaningful only if it advances theoretical understanding, addresses the identified research gap, or contributes practical insights to the field. Consequently, this chapter encourages readers to view SmartPLS results as evidence for evaluating scientific theories rather than as isolated statistical outputs.

By the end of this chapter, readers will be able to construct a complete SmartPLS model, evaluate reflective and formative measurement models, assess the structural model, interpret statistical results confidently, test theory-driven hypotheses, and prepare publication-quality findings consistent with APA 7 and international journal standards. More importantly, they will understand that statistical analysis is not the destination of scientific research but one stage in the broader process of building, testing, refining, and extending scientific theory.

Chapter 4 therefore represents the transition from research design to empirical evidence. The theoretical foundations established in the previous chapters now become testable models, allowing researchers to determine whether the proposed explanations are supported by the observed data. In doing so, the research journey advances from asking "What should happen according to theory?" to answering the more important scientific question: *"What does the empirical evidence reveal about the validity of the theory?"*

4.1 Introduction to SmartPLS and PLS-SEM

SmartPLS is not the starting point of research. It is the analytical tool used to evaluate whether empirical evidence supports the proposed theoretical model.

Theory → Measurement → SmartPLS → Results → Theory Evaluation

4.1.1 Introduction

Throughout the first three chapters of this book, we have emphasized one fundamental principle: *Good statistical analysis begins with good theory***.** Researchers first identify a research problem, review the literature, select an appropriate scientific theory, develop a conceptual framework, formulate hypotheses, and design a valid measurement instrument. Only after these stages have been completed is the study ready for empirical analysis.

This chapter marks an important transition in the research process. For the first time, the researcher moves from research design to data analysis. The objective is no longer to develop the theoretical model but to determine whether the collected data support the theoretical relationships proposed earlier. This evaluation requires more than traditional statistical techniques.

Most theory-driven studies investigate multiple constructs simultaneously. These constructs are often measured indirectly through several questionnaire items, and they may influence one another through direct, indirect, mediating, or moderating relationships. Analyzing such complex relationships requires a statistical approach capable of estimating both the measurement model and the structural model simultaneously. One of the most widely used methods for this purpose is Partial Least Squares Structural Equation Modeling (PLS-SEM).

Today, PLS-SEM has become one of the dominant analytical methods in business, information systems, education, healthcare, marketing, engineering, psychology, and the social sciences because it allows researchers to evaluate complex theoretical models while accommodating latent constructs measured by multiple indicators. The most widely used software for conducting PLS-SEM analysis is SmartPLS.

4.1.2 What Is Structural Equation Modeling?

Structural Equation Modeling (SEM) is a multivariate statistical technique that enables researchers to examine relationships among multiple variables simultaneously. Unlike traditional statistical methods that typically analyze one relationship at a time, SEM allows researchers to investigate an entire theoretical model in a single analysis.

For example, consider the following theory-driven research model. Performance Expectancy influences AI Adoption. Trust in AI also influences AI Adoption. AI Adoption subsequently influences Teaching Innovation. Rather than analyzing each relationship separately, SEM estimates all relationships simultaneously while accounting for measurement error and the relationships among latent constructs. This capability makes SEM particularly suitable for testing scientific theories. Instead of asking isolated statistical questions, researchers evaluate whether an entire theoretical framework is supported by empirical evidence.

4.1.3 Two Approaches to Structural Equation Modeling

Structural Equation Modeling consists of two major approaches. The first is Covariance-Based Structural Equation Modeling (CB-SEM). The second is Partial Least Squares Structural Equation Modeling (PLS-SEM). Although both approaches estimate relationships among latent constructs, they differ in their objectives, assumptions, and applications.

CB-SEM focuses primarily on confirming well-established theories. Its objective is to determine how well the proposed theoretical model reproduces the observed covariance matrix. Researchers commonly use CB-SEM when:

- Testing mature theories.
- Evaluating overall model fit.
- Working with relatively large samples.
- Assuming multivariate normality.

Popular CB-SEM software includes AMOS, LISREL, EQS, and Mplus.

PLS-SEM focuses primarily on maximizing the explained variance of endogenous constructs and improving prediction. Rather than emphasizing overall model fit, PLS-SEM evaluates how well the theoretical model explains and predicts the phenomenon under investigation.
Researchers commonly use PLS-SEM when:

- Developing or extending theory.
- Predicting key outcomes.
- Analyzing complex research models.
- Working with smaller sample sizes.
- Analyzing non-normal data.

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- Including formative measurement models.

SmartPLS is the most widely used software for implementing PLS-SEM.

Table 4.1: Comparing CB-SEM and PLS-SEM

Characteristic	*CB-SEM*	*PLS-SEM*
Primary objective	Theory confirmation	Prediction and theory development
Main focus	Model fit	Explained variance and prediction
Data assumptions	Multivariate normality preferred	Fewer distributional assumptions
Sample size	Generally larger	Suitable for small to large samples
Model complexity	Moderate	High
Formative constructs	Limited support	Strong support
Typical software	AMOS, LISREL, Mplus	SmartPLS

4.1.4 Why Researchers Choose SmartPLS

The popularity of SmartPLS has increased substantially over the past two decades. Several factors explain this growth. First, SmartPLS supports theory-driven research. Researchers can analyze complex conceptual frameworks containing multiple constructs, mediators, moderators, and higher-order constructs. Second, SmartPLS accommodates latent constructs. Rather than analyzing questionnaire items individually, SmartPLS estimates the latent variables represented by those indicators. This makes it particularly suitable for behavioral and social science research.

Third, SmartPLS is prediction-oriented. Many contemporary research studies seek not only to explain phenomena but also to predict future outcomes. PLS-SEM is especially effective for predictive research. Fourth, SmartPLS handles complex research models.
Models containing numerous constructs and structural relationships can often be estimated successfully using PLS-SEM. Fifth, SmartPLS is flexible. Researchers can analyze reflective and formative constructs within the same model, making it applicable to a wide range of research disciplines.

4.1.5 Common Research Applications

PLS-SEM is now applied across numerous academic disciplines. Examples include:
Information Systems

- Technology adoption
- Digital transformation
- Cybersecurity
- Artificial intelligence

Business and Management

- Leadership
- Organizational performance
- Innovation
- Customer satisfaction

Marketing

- Consumer behavior
- Brand loyalty
- Purchase intention
- Service quality

Education

- E-learning adoption

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- Teaching innovation
- Student engagement
- Digital competence

Healthcare

- Technology acceptance
- Patient satisfaction
- Health information systems
- Telemedicine adoption

Regardless of the discipline, the underlying objective remains the same: to evaluate theoretically proposed relationships using empirical evidence.

4.1.6 Strengths and Limitations of SmartPLS

Like every statistical method, SmartPLS has strengths and limitations. Researchers should understand both before selecting an analytical approach.

Strengths

- Handles complex theoretical models efficiently.
- Supports reflective and formative constructs.
- Suitable for prediction-oriented research.
- Accommodates smaller sample sizes.
- Requires fewer assumptions regarding data distribution.
- Widely accepted across many research disciplines.

Limitations

- Does not emphasize global model fit in the same way as CB-SEM.
- Requires strong theoretical justification despite its analytical flexibility.
- Results should not be interpreted solely on the basis of statistical significance.
- Incorrect specification of the measurement model can seriously affect conclusions.

Understanding these limitations encourages responsible use of SmartPLS rather than mechanical application of statistical procedures.

4.1.7 SmartPLS Does Not Replace Scientific Thinking

One of the most common misconceptions among beginning researchers is believing that SmartPLS automatically determines whether a study is scientifically sound. This is incorrect. SmartPLS evaluates only the model specified by the researcher. If the theoretical framework is weak, the constructs are poorly defined, or the measurement instrument lacks quality, SmartPLS cannot correct these weaknesses.

Instead, the software faithfully analyzes the data according to the model provided. Consequently, successful PLS-SEM research depends far more on research design than on software operation. Researchers should therefore view SmartPLS as a powerful analytical tool rather than a substitute for scientific reasoning.

4.1.8 Running Case Study

The AI Adoption project is now ready for statistical analysis.

The researcher has completed the following stages:

✓ Research problem identified.

✓ Scientific theory selected.

✓ Conceptual framework developed.

✓ Research hypotheses formulated.

✓ Measurement instrument designed.

✓ Questionnaire validated.

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✓ Data collected from university instructors.
The next task is to determine whether the collected data support the proposed theoretical model. SmartPLS will now be used to evaluate:

- The measurement model.
- The structural model.
- The research hypotheses.
- The theoretical contribution of the study.

The software will not determine whether the theory is correct. Instead, it will provide empirical evidence that enables the researcher to evaluate the proposed theoretical relationships.

Structural Equation Modeling enables researchers to evaluate complete theoretical models involving multiple latent constructs and relationships. Among the available SEM approaches, PLS-SEM has become one of the most widely used methods because of its predictive orientation, flexibility, and ability to analyze complex models. SmartPLS provides the analytical environment for implementing PLS-SEM, but meaningful results depend on strong theory, sound measurement, and careful interpretation. Statistical software evaluates the model specified by the researcher—it does not replace scientific thinking.

4.2 Building the SmartPLS Model

A SmartPLS project is a statistical representation of the conceptual framework developed from scientific theory.

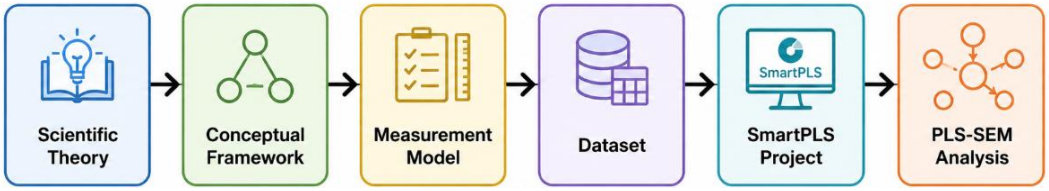

Figure 4.1: From Conceptual Framework to SmartPLS Model

4.2.1 Introduction

By the beginning of Chapter 4, the researcher has completed the entire research design process. The theoretical model has been established, hypotheses have been formulated, constructs have been operationalized, the questionnaire has been validated, and data have been collected from the target population. The next step is to translate this work into a SmartPLS project. Many beginning researchers think that building a SmartPLS model is mainly a software task involving drawing circles and connecting arrows. While these actions are necessary, they are not the most important aspect of model development.

The real objective is to ensure that the SmartPLS model *faithfully represents the conceptual framework* developed from theory. Every construct, indicator, and structural relationship drawn in SmartPLS should correspond directly to the research model presented in Chapter 2. In other words, researchers do not create a new model in SmartPLS—they reproduce the theoretical model already developed through scientific reasoning.

4.2.2 Preparing the Dataset

Before opening SmartPLS, researchers should ensure that the dataset is complete, accurate, and properly organized. Each row should represent one respondent. Each column should represent one observed variable (questionnaire item). Although SmartPLS accepts several file formats,

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spreadsheets should be cleaned before import to reduce errors during analysis. A simplified example is shown below.

Respondent	*PE1*	*PE2*	*PE3*	*TAI1*	*TAI2*	*TAI3*	*AIA1*	*AIA2*	*AIA3*
1	4	5	4	4	5	4	5	4	5
2	3	4	3	3	4	3	4	4	3
3	5	5	5	5	5	5	5	5	5

The dataset should contain:

- Consistent variable names.
- Numerical responses.
- No duplicated columns.
- No merged cells.
- No unnecessary formatting.

4.2.3 Importing Data into SmartPLS

Once the dataset has been prepared, it can be imported into SmartPLS. Although the exact interface may change across software versions, the general workflow remains similar. Researchers typically:

1. Create a new SmartPLS project.
2. Import the dataset.
3. Verify that all variables are recognized correctly.
4. Confirm that the imported variable names match the questionnaire coding system.

At this stage, researchers should check carefully for:

- Missing indicator names.
- Incorrect variable labels.
- Unexpected data types.
- Coding inconsistencies.

Correcting these issues immediately prevents unnecessary problems later during model estimation.

4.2.4 Creating Latent Constructs

After importing the data, researchers create the latent constructs included in the conceptual framework. For the running case study, the constructs include:

- Performance Expectancy
- Effort Expectancy
- Social Influence
- Facilitating Conditions
- Trust in AI
- Digital Competence
- AI Adoption
- Teaching Innovation

Each construct appears as a separate latent variable within the SmartPLS workspace. These constructs represent the theoretical concepts introduced in Chapters 2 and 3. They should not be added or removed simply because the software allows it. Every construct must have a clear theoretical justification.

4.2.5 Assigning Indicators to Constructs

The assignment process should follow the measurement model developed in Chapter 3. Indicators should never be assigned based on statistical expectations. Instead, each indicator

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should represent the theoretical definition of the construct. Incorrect indicator assignment weakens the validity of the measurement model and may invalidate the subsequent analysis.
After creating the latent constructs, researchers assign the corresponding indicators. For example:

Construct	Indicators
Performance Expectancy	PE1, PE2, PE3, PE4
Trust in AI	TAI1, TAI2, TAI3, TAI4
AI Adoption	AIA1, AIA2, AIA3, AIA4
Teaching Innovation	TI1, TI2, TI3, TI4

4.2.6 Specifying Reflective and Formative Measurement Models

The next step is specifying whether each construct is reflective or formative. This decision was made during Chapter 3 based on theoretical reasoning. Researchers should therefore reproduce—not reconsider—that decision. For reflective constructs, arrows point from the construct toward the indicators. For formative constructs, arrows point from the indicators toward the construct. SmartPLS allows both measurement models within the same research project. However, researchers should remember that: *The software implements the measurement model. It does not determine the correct model.* Only theoretical reasoning determines whether a construct is reflective or formative.

4.2.7 Drawing the Structural Model

Once the measurement model has been completed, researchers specify the structural relationships among constructs. These relationships correspond directly to the research hypotheses. For the AI adoption study, the structural model includes paths such as:

- Performance Expectancy → AI Adoption
- Effort Expectancy → AI Adoption
- Social Influence → AI Adoption
- Facilitating Conditions → AI Adoption
- Trust in AI → AI Adoption
- Digital Competence → AI Adoption
- AI Adoption → Teaching Innovation

Each arrow represents a proposed causal relationship derived from scientific theory.
The structural model should therefore be identical to the conceptual framework developed before data collection.

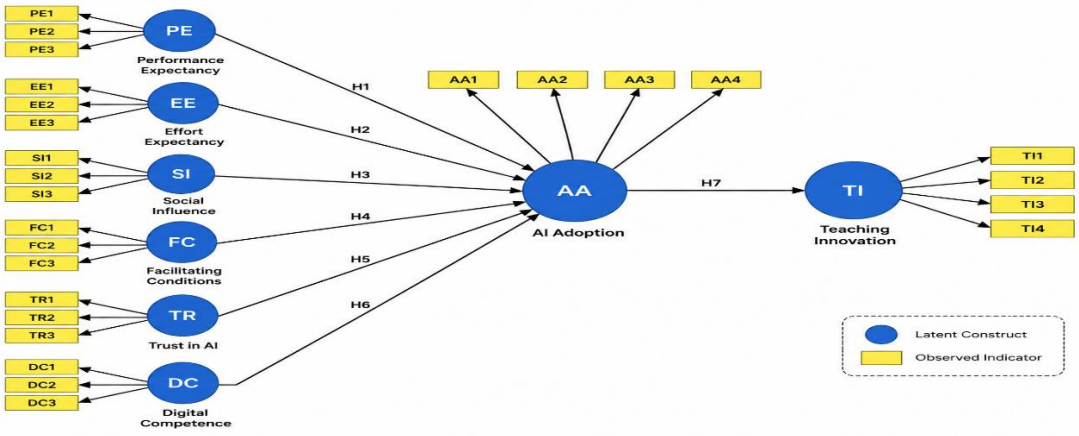

Figure 4.2: Conceptual Framework → SmartPLS Project

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4.2.8 Verifying the Model Before Estimation

Before estimating the model, researchers should perform a final verification.
The following checklist is recommended.

✓ All constructs are included.

✓ Every construct has the correct indicators.

✓ Indicator coding matches the dataset.

✓ Measurement models are specified correctly.

✓ Structural paths correspond to the research hypotheses.

✓ No indicators are assigned incorrectly.

✓ Dataset variables match questionnaire items.

Researchers should resist the temptation to modify the model simply because it appears visually attractive. Every component of the model should be justified theoretically.

Table 4.2 :SmartPLS Model Verification Checklist

Verification Item	*Completed*
Dataset imported successfully	☐
Construct names verified	☐
Indicator assignments checked	☐
Reflective/formative specification verified	☐
Structural paths confirmed	☐
Coding consistency verified	☐
Model matches conceptual framework	☐

4.2.9 Running Case Study

The researcher now builds the SmartPLS model for the AI adoption study.
The completed project includes:

- Eight latent constructs.
- Thirty-two observed indicators.
- Seven hypothesized structural relationships.
- Reflective measurement models for all constructs.

After importing the dataset and assigning all indicators correctly, the researcher compares the SmartPLS model with the original conceptual framework developed in Chapter 2. The comparison confirms complete consistency. The statistical model therefore represents the theoretical model accurately. The project is now ready for model estimation.

Building a SmartPLS model is not merely a software activity but a process of translating a theory-driven conceptual framework into a statistical model. Every construct, indicator, and structural relationship should be supported by theory and correspond directly to the research design developed before data collection. Careful model specification provides the foundation for accurate measurement model evaluation, structural model assessment, and hypothesis testing in the sections that follow.

4.3 Evaluating the Measurement Model

Before researchers examine relationships among constructs, they must first demonstrate that the constructs have been measured accurately.

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Figure 4.3: The Role of Measurement Model Evaluation

4.3.1 Introduction

The first statistical task after building a SmartPLS model is evaluating the measurement model. Many beginning researchers are eager to test their hypotheses immediately after importing their data into SmartPLS. They often examine path coefficients before determining whether the constructs themselves have been measured reliably and validly. This approach is incorrect.

A structural model can only be interpreted if the measurement model has first demonstrated acceptable quality. An easy analogy is building a house. The structural model represents the upper floors of the building. The measurement model represents the foundation. No engineer would evaluate the stability of the upper floors without first ensuring that the foundation is strong. The same principle applies to PLS-SEM. If the measurement model is weak, conclusions drawn from the structural model become questionable regardless of how statistically significant the path coefficients appear. Consequently, measurement model evaluation should always precede structural model evaluation.

4.3.2 Why Do We Evaluate the Measurement Model?

Measurement model evaluation answers one fundamental question: *Do the observed indicators measure the theoretical constructs accurately?*. Remember that SmartPLS does not analyze questionnaire items individually. Instead, it estimates *latent constructs* using multiple observed indicators. Before researchers interpret relationships among constructs, they must demonstrate that the indicators provide reliable and valid representations of those constructs. Measurement model evaluation therefore provides evidence that:

- Indicators represent the intended construct.
- Measurement is internally consistent.
- Different constructs are empirically distinct.
- The statistical analysis truly reflects the underlying theory.

Without this evidence, hypothesis testing becomes scientifically unreliable. Measurement model evaluation determines whether the indicators provide trustworthy representations of the latent constructs

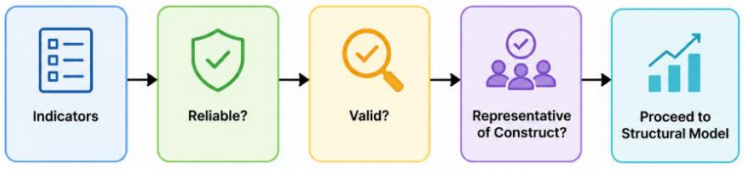

Figure 4.4: Purpose of Measurement Model Evaluation

4.3.3 Two Types of Measurement Models

The evaluation procedure depends on the measurement model specified in Chapter 3. There are two possibilities. Reflective Measurement Models, The construct causes the indicators. Examples include:

- Trust
- Satisfaction

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- Behavioral Intention
- Performance Expectancy
- AI Adoption

These constructs are evaluated using reliability and validity criteria.

Formative Measurement Models, The indicators create the construct. Examples include:

- Organizational Resources
- Digital Infrastructure
- Socioeconomic Status
- Service Quality Index

These constructs require different evaluation procedures because the indicators represent unique components of the construct.
Researchers should never evaluate formative constructs using reflective criteria.

Table 4.3: Evaluation Criteria

Reflective Constructs	*Formative Constructs*
Indicator Reliability	Indicator Significance
Internal Consistency Reliability	Multicollinearity
Convergent Validity	Outer Weights
Discriminant Validity	Indicator Relevance

4.3.4 Evaluating Reflective Measurement Models :- Indicator Reliability

The first criterion is *indicator reliability*. Indicator reliability examines how strongly each indicator is associated with its latent construct. SmartPLS reports this relationship using the *outer loading*. An outer loading can range from -1 to +1. The closer the loading is to **1**, the better the indicator represents the construct. As a general guideline:

Outer Loading	*Interpretation*
≥ 0.70	Excellent
0.60–0.69	Acceptable if theoretically justified
0.40–0.59	Consider removal after evaluating overall model quality
< 0.40	Usually removed

Researchers should remember that these values are *guidelines rather than absolute rules*.
Indicators should never be deleted automatically simply because one loading falls slightly below 0.70. Theoretical importance should always be considered first.

Example; Suppose the construct *Trust in AI* produces the following loadings.

Indicator	*Loading*
TAI1	0.86
TAI2	0.84
TAI3	0.81
TAI4	0.67

Although TAI4 is below 0.70, it measures an important theoretical aspect of trust. The researcher may therefore retain the indicator if the remaining reliability and validity statistics remain satisfactory.

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4.3.5 Internal Consistency Reliability

Once acceptable indicator reliability has been established, researchers evaluate whether the indicators measure the construct consistently. Three statistics are commonly reported. Cronbach's Alpha is the traditional measure of internal consistency. Although widely used, it assumes that all indicators contribute equally to the construct. Because this assumption is often unrealistic, researchers should not rely exclusively on Cronbach's Alpha.

Composite Reliability (CR) is generally preferred in PLS-SEM because it considers the actual outer loadings estimated by the model. It therefore provides a more realistic estimate of reliability.

rho_A is another reliability coefficient increasingly recommended in recent PLS-SEM literature because it often provides a more accurate estimate of construct reliability.

General Guidelines

Statistic	*Recommended Value*
Cronbach's Alpha	≥ 0.70
Composite Reliability	0.70–0.95
rho_A	≥ 0.70

Very high reliability values (above approximately 0.95) may indicate that questionnaire items are excessively similar and therefore redundant. Researchers should seek consistency without unnecessary repetition.

4.3.6 Convergent Validity

Convergent validity examines whether the indicators actually converge to measure the same construct. The most commonly used statistic is the *Average Variance Extracted (AVE).*
AVE represents the average proportion of variance explained by the construct in its indicators. The recommended guideline is: $AVE \geq 0.50$. An AVE of 0.50 indicates that the construct explains at least half of the variance in its indicators. If AVE falls below this threshold, researchers should investigate whether weak indicators or poorly designed measurement items are responsible. Example:

Construct	*AVE*
Trust in AI	0.71
AI Adoption	0.69
Teaching Innovation	0.74

All constructs demonstrate satisfactory convergent validity.

4.3.7 Discriminant Validity

Convergent validity confirms that indicators belong together. Discriminant validity confirms that different constructs are actually different. For example: Trust in AI should not measure Digital Competence. Teaching Innovation should not measure Performance Expectancy. If two constructs cannot be distinguished empirically, the theoretical model becomes difficult to interpret. Three approaches are commonly reported.

Fornell–Larcker Criterion; The square root of each construct's AVE should exceed its correlations with other constructs. Cross Loadings; Each indicator should load more strongly on its own construct than on any other construct.

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The *Heterotrait–Monotrait Ratio (HTMT***)** has become the preferred approach. General guideline: HTMT < 0.85. (Some disciplines accept values below 0.90.) Recent SmartPLS literature recommends emphasizing HTMT because it has demonstrated greater sensitivity in detecting discriminant validity problems.

Table 4.4: Summary of Reflective Measurement Model Evaluation

Criterion	*Recommended Guideline*
Outer Loading	≥ 0.70
Cronbach's Alpha	≥ 0.70
Composite Reliability	0.70–0.95
rho_A	≥ 0.70
AVE	≥ 0.50
HTMT	< 0.85 (or <0.90 depending on context)

4.3.8 Formative Measurement Evaluation

Unlike reflective constructs, formative constructs are not evaluated using reliability statistics. Instead, researchers examine:

- Indicator significance
- Outer weights
- Multicollinearity
- Variance Inflation Factor (VIF)

The objective is to determine whether each indicator contributes uniquely to forming the construct. Indicators should not be removed simply because they are weakly correlated with one another. In formative models, different indicators are expected to represent different dimensions.

Table 4.5: Formative Evaluation

Criterion	*Purpose*
Outer Weight	Contribution of each indicator
Bootstrapping	Statistical significance
VIF	Detect multicollinearity

4.3.9 Decision-Making

After completing the measurement model evaluation, researchers decide whether the model is acceptable.

Possible decisions include:

✓ Accept the measurement model.

✓ Revise weak indicators.

✓ Remove theoretically unnecessary indicators.

✓ Collect additional data if serious problems remain.

Only after the measurement model has demonstrated acceptable quality should researchers proceed to evaluating the structural model.

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4.3.10 Running Case Study

The AI Adoption study contains eight reflective constructs.
After estimating the model in SmartPLS, the researcher obtains the following results:

- Outer loadings range from 0.73 to 0.91.
- Cronbach's Alpha values range from 0.82 to 0.91.
- Composite Reliability values range from 0.87 to 0.94.
- AVE values range from 0.64 to 0.78.
- HTMT values range from 0.41 to 0.79.

All values satisfy the recommended guidelines. The researcher therefore concludes that the measurement model demonstrates acceptable reliability and validity. The study is now ready for structural model evaluation.

The objective of measurement model evaluation is *not to obtain perfect statistics*.
Its objective is to determine whether the measurement instrument provides a sufficiently accurate representation of the theoretical constructs. Always remember:
Theory determines what should be measured. SmartPLS determines how well it has been measured.

Measurement model evaluation establishes whether the observed indicators provide reliable and valid representations of the theoretical constructs. Reflective constructs are assessed using indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, whereas formative constructs are evaluated through indicator significance, outer weights, and multicollinearity. Only after demonstrating satisfactory measurement quality should researchers proceed to evaluate the structural model and test their hypotheses

4.4 Evaluating the Structural Model

Once the measurement model has been validated, researchers evaluate the structural relationships proposed by the theoretical framework.

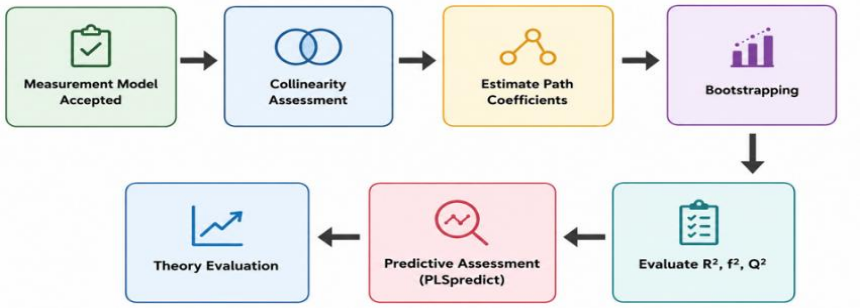

Figure 4.5: Structural Model Evaluation Process

4.4.1 Introduction

After confirming that the measurement model is reliable and valid, researchers may proceed to the second major stage of PLS-SEM analysis: *evaluating the structural model*. The measurement model answers the question: *Have the theoretical constructs been measured accurately?*. The structural model answers a different question: *Do the relationships proposed by the theory actually exist?*. This distinction is fundamental. A measurement model focuses on the quality of the constructs.

A structural model focuses on the relationships among those constructs. In other words, the structural model evaluates whether the empirical evidence supports the research hypotheses developed in Chapter 2. This stage therefore represents the point at which statistical analysis begins to evaluate scientific theory.

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4.4.2 Purpose of Structural Model Evaluation

The structural model represents the theoretical relationships among latent constructs.
For example, in the running case study, the proposed theory suggests that:

- Performance Expectancy influences AI Adoption.
- Trust in AI influences AI Adoption.
- Digital Competence influences AI Adoption.
- AI Adoption influences Teaching Innovation.

Structural model evaluation determines whether these relationships are supported by the observed data.

Unlike traditional regression analysis, which often examines one relationship at a time, SmartPLS evaluates all structural relationships simultaneously while accounting for the measurement model established earlier. The goal is not merely to identify statistically significant relationships but to determine how well the theoretical model explains and predicts the phenomenon under investigation. The structural model specifies the theoretical relationships among latent constructs.

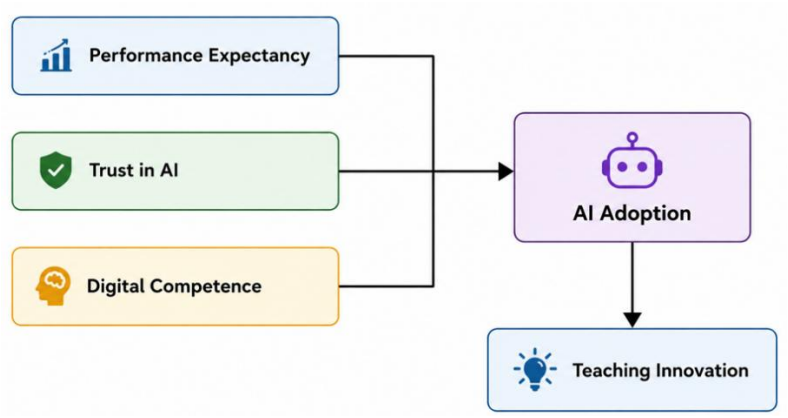

Figure 4.6: The Structural Model

4.4.3 Assessing Collinearity

Before interpreting structural relationships, researchers should examine *collinearity* among predictor constructs. Collinearity occurs when two or more independent constructs are highly correlated. Excessive collinearity makes it difficult to determine the unique contribution of each predictor. SmartPLS evaluates collinearity using the Variance Inflation Factor (VIF).
General guideline:

VIF Value	*Interpretation*
Below 3	Excellent
3–5	Generally acceptable
Above 5	Potential collinearity problem

High VIF values suggest that predictor constructs overlap substantially and may reduce the stability of path coefficient estimates. If serious collinearity exists, researchers should reconsider the conceptual framework or examine whether constructs are conceptually distinct.
Low VIF values indicate that each predictor contributes unique information to the structural model. High VIF values should be investigated before interpreting path coefficients.

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4.4.4 Path Coefficients

The most recognizable output produced by SmartPLS is the *path coefficient*. A path coefficient represents the estimated relationship between two latent constructs. It is similar to a standardized regression coefficient. Path coefficients range approximately from **–1 to +1**. Positive coefficients indicate positive relationships. Negative coefficients indicate inverse relationships. Values closer to zero indicate weaker relationships. For example:

Relationship	*Path Coefficient*
Performance Expectancy → AI Adoption	0.42
Trust in AI → AI Adoption	0.29
Digital Competence → AI Adoption	0.24

These values suggest that Performance Expectancy has the strongest direct influence on AI Adoption. However, path coefficients alone are insufficient. Researchers must determine whether these relationships are statistically significant. Path coefficients estimate the strength and direction of relationships among latent constructs. Example Structural Relationships

Performance Expectancy ⟶ β = 0.42 ⟶► AI Adoption ⟶ β = 0.55 ⟶► Teaching Innovation

4.4.5 Bootstrapping

Because PLS-SEM does not assume that sampling distributions follow a normal distribution, statistical significance is evaluated using *bootstrapping.* Bootstrapping is a resampling procedure that repeatedly draws samples from the original dataset. Thousands of bootstrap samples are typically generated. These samples are used to estimate:

- Standard errors.
- t-values.
- p-values.
- Confidence intervals.

Bootstrapping enables researchers to determine whether the estimated relationships are statistically significant. In modern PLS-SEM studies, *5,000 bootstrap samples* are commonly recommended, although researchers should follow current methodological guidance and justify their chosen settings.

Table 4.6: Typical Bootstrapping Output

Relationship	*β*	*t*	*p*
PE → AI Adoption	0.42	6.91	<0.001
Trust → AI Adoption	0.29	4.83	<0.001
AI Adoption → Teaching Innovation	0.55	8.74	<0.001

4.4.6 Coefficient of Determination (R^2)

One of the most important statistics in PLS-SEM is the *coefficient of determination (R^2).* R^2 indicates how much variance in an endogenous construct is explained by its predictor constructs. For example, Suppose AI Adoption has: $R^2 = 0.58$. This means that 58% of the variation in AI Adoption is explained by the constructs included in the model. Higher R^2 values indicate greater explanatory power. However, acceptable R^2 values vary across research disciplines. Researchers should therefore interpret R^2 within the context of previous literature rather than relying solely on general guidelines. Example:-

Construct	*R^2*
AI Adoption	0.58

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Construct	R^2
Teaching Innovation	0.46

These values suggest that the theoretical model explains a substantial proportion of the variance in both constructs. R^2 evaluates how well the theoretical model explains the endogenous constructs.

4.4.7 Effect Size (f^2)

While R^2 evaluates the explanatory power of the complete model, **effect size (f^2)** evaluates the contribution of each individual predictor. Suppose Trust in AI is removed from the model. If R^2 decreases substantially, Trust in AI has a large effect. If R^2 changes only slightly, its effect is relatively small. General guidelines are often reported as:

f^2	*Interpretation*
0.02	Small
0.15	Medium
0.35	Large

These values should be interpreted as guidelines rather than strict decision rules.
Researchers should also consider theoretical importance.

4.4.8 Predictive Relevance (Q^2)

PLS-SEM emphasizes prediction as well as explanation. One measure of predictive capability is Q^2, obtained through the blindfolding procedure. Q^2 evaluates whether the model predicts omitted data points better than chance. General interpretation:

Q^2 Value	*Interpretation*
Above 0	Predictive relevance exists
Zero or below	No predictive relevance

A positive Q^2 suggests that the theoretical model possesses predictive capability for the endogenous construct.

4.4.9 Predictive Performance Using PLSpredict

Recent developments in PLS-SEM emphasize prediction beyond explanation. For this reason, SmartPLS includes *PLSpredict,* a procedure designed to evaluate out-of-sample predictive performance. Rather than asking: *How well does the model explain the current data?*. PLSpredict asks: *How well would the model predict new observations?*. This distinction is particularly important in applied research, where prediction is often one of the primary objectives. Researchers should compare prediction errors from the PLS model with those from simple benchmark models. If the PLS model demonstrates lower prediction errors, it provides evidence of meaningful predictive performance. Modern PLS-SEM emphasizes both explanation and prediction.

4.4.10 Integrating the Results

Structural model evaluation should never focus on a single statistic. Researchers should integrate all available evidence. For example:

- VIF values indicate acceptable collinearity.
- Path coefficients are statistically significant.
- R^2 demonstrates satisfactory explanatory power.

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- f^2 identifies the relative importance of predictors.
- Q^2 indicates predictive relevance.
- PLSpredict confirms predictive performance.

Together, these statistics provide a comprehensive evaluation of the theoretical model. Researchers should interpret them collectively rather than independently.

4.4.11 Running Case Study

The AI adoption model is estimated using SmartPLS. The results indicate:

- VIF values range from 1.28 to 2.11.
- All path coefficients are positive and statistically significant.
- AI Adoption achieves $R^2 = 0.61$.
- Teaching Innovation achieves $R^2 = 0.49$.
- f^2 values indicate that Performance Expectancy has the largest effect on AI Adoption.
- Q^2 values are positive for all endogenous constructs.
- PLSpredict demonstrates that the model predicts new observations more accurately than the benchmark model.

Taken together, these findings suggest that the proposed theoretical model provides both explanatory and predictive value. The next stage is to determine whether each individual hypothesis is supported. Many researchers celebrate statistically significant path coefficients while ignoring the overall explanatory and predictive performance of the model. This is a mistake. A statistically significant relationship may have little practical importance. Always ask: *Does this relationship contribute meaningfully to explaining or predicting the phenomenon?*. Scientific contribution depends on interpretation, not significance alone.

Structural model evaluation determines whether empirical evidence supports the theoretical relationships proposed by the research model. Researchers should assess collinearity, interpret path coefficients using bootstrapping, evaluate explanatory power through R^2, examine the contribution of individual predictors using f^2, assess predictive relevance with Q^2, and evaluate predictive performance using PLSpredict. Together, these statistics enable researchers to judge not only whether the theory is supported but also how effectively it explains and predicts the phenomenon under investigation.

4.5 Hypothesis Testing

Hypothesis testing connects empirical evidence with the theoretical propositions developed during the research design stage.

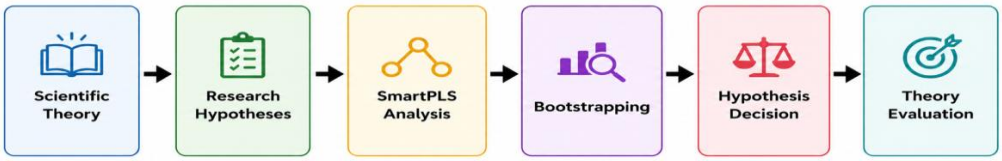

Figure 4.7: From Theory to Hypothesis Testing

4.5.1 Introduction

The ultimate purpose of Structural Equation Modeling is not simply to estimate statistical models but to evaluate scientific theories. Throughout the earlier chapters of this book, hypotheses were developed from established theories and supported by previous research. These hypotheses represented the researcher's expectations regarding the relationships among latent constructs. Once the measurement model and structural model have been evaluated successfully, researchers are ready to answer the central question of empirical research: *Does*

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the empirical evidence support the proposed theoretical relationships?. Hypothesis testing provides the answer.

It is important to remember that researchers do not prove hypotheses to be true. Instead, they examine whether the available empirical evidence provides sufficient statistical support for the proposed theoretical relationships. Consequently, hypothesis testing should be viewed as an evaluation of theory rather than a search for statistically significant numbers.

4.5.2 What Is a Research Hypothesis?

A *research hypothesis* is a theoretically derived statement predicting a relationship between two or more constructs. For example: *H1***:** Performance Expectancy positively influences AI Adoption. This hypothesis originates from the Unified Theory of Acceptance and Use of Technology (UTAUT), which proposes that individuals are more likely to adopt a technology when they believe it will improve their performance.

Similarly, *H2***:** Trust in AI positively influences AI Adoption. This hypothesis reflects the expectation that instructors who perceive AI as reliable and dependable are more likely to adopt it in their teaching activities. Each hypothesis therefore represents a theoretical prediction that can be evaluated using empirical data.

4.5.3 Testing Direct Effects

The simplest hypotheses examine *direct relationships* between two constructs. Examples include:

- Performance Expectancy → AI Adoption
- Trust in AI → AI Adoption
- AI Adoption → Teaching Innovation

SmartPLS estimates each relationship using:

- Path coefficient (β)
- Standard error
- t-value
- p-value
- Confidence interval

These statistics are generated through bootstrapping.

Researchers typically evaluate direct effects using three questions.
1. Is the relationship statistically significant? A significant p-value indicates that the relationship is unlikely to have occurred by chance.
2. What is the direction of the relationship? Positive coefficients indicate positive relationships. Negative coefficients indicate inverse relationships.
3. How strong is the relationship? Larger standardized path coefficients generally indicate stronger relationships, although interpretation should always consider theoretical context.

Table 4.7: Example of Direct Effect Results

Hypothesis	*Path (β)*	*t-value*	*p-value*	*Decision*
H1	0.42	6.91	<0.001	Supported
H2	0.29	4.83	<0.001	Supported
H3	0.18	2.41	0.016	Supported

Direct hypotheses are evaluated using bootstrapped path coefficients and significance tests.

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4.5.4 Testing Indirect Effects (Mediation)

Many research models propose that one construct influences another *through a mediator*. For example, Performance Expectancy may increase AI Adoption, which subsequently enhances Teaching Innovation. In this case: AI Adoption functions as a *mediating variable*. The indirect relationship is evaluated using bootstrapping in the same way as direct effects.
Researchers examine:

- Indirect path coefficient.
- t-value.
- p-value.
- Confidence interval.

If the indirect effect is statistically significant, mediation exists. Researchers should then determine whether the mediation is:

- Full mediation.
- Partial mediation.
- No mediation.

This decision depends on the significance of both the direct and indirect effects. Mediation occurs when the influence of one construct on another operates through an intermediate construct.

4.5.5 Testing Moderating Effects

A *moderator* changes the strength or direction of a relationship between two constructs. For example, The relationship between AI Adoption and Teaching Innovation may become stronger for instructors with high levels of Digital Competence. In this case, Digital Competence functions as a moderator. Moderation analysis evaluates whether the interaction effect is statistically significant. Researchers should interpret moderation carefully because statistically significant interaction effects may be difficult to explain without strong theoretical support. A moderator influences the strength or direction of a structural relationship.

4.5.6 Higher-Order Constructs

Some theoretical models contain *higher-order constructs*, also known as hierarchical component models. For example, Digital Readiness may consist of:

- Digital Competence.
- Digital Infrastructure.
- Institutional Support.

Together, these lower-order constructs form a broader higher-order construct. SmartPLS provides several approaches for estimating higher-order models, including the repeated indicators approach and the two-stage approach. The selection of an appropriate method depends on the research design and theoretical structure of the model. Higher-order constructs should only be used when supported by a strong theoretical justification.

4.5.7 Making Hypothesis Decisions

After examining the statistical results, researchers decide whether each hypothesis is supported. This decision should consider:

- Statistical significance.
- Direction of the relationship.
- Consistency with theory.
- Practical importance.

A hypothesis is generally reported as:

- Supported.

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- Not Supported.

Researchers should avoid expressions such as:

- Proven.
- Confirmed beyond doubt.
- Accepted as true.

Scientific theories remain open to future testing and refinement.

Table 4.8: Hypothesis Summary Table

Hypothesis	*Proposed Relationship*	*β*	*p-value*	*Decision*
H1	PE → AI Adoption	0.42	<0.001	Supported
H2	Trust → AI Adoption	0.29	<0.001	Supported
H3	Digital Competence → AI Adoption	0.18	0.016	Supported
H4	AI Adoption → Teaching Innovation	0.55	<0.001	Supported

A hypothesis summary table provides readers with a concise overview of the empirical findings.

4.5.8 Interpreting Unexpected Results

Not all hypotheses are supported. This should not be viewed as a research failure. Unexpected findings often provide valuable opportunities for theoretical refinement. Possible explanations include:

- Contextual differences.
- Cultural factors.
- Measurement limitations.
- Sampling characteristics.
- Emerging technologies.
- Changes in user behavior.

Researchers should compare unexpected findings with previous literature and discuss possible explanations rather than simply reporting statistical outcomes. Scientific progress frequently occurs when empirical evidence challenges existing theoretical assumptions.

4.5.9 Statistical Significance versus Theoretical Significance

One of the most common mistakes in empirical research is assuming that statistical significance automatically implies scientific importance. A statistically significant relationship may have:

- A very small effect.
- Limited practical relevance.
- Minimal theoretical contribution.

Conversely, A non-significant finding may reveal important theoretical insights if it challenges existing assumptions or identifies boundary conditions. Researchers should therefore evaluate hypotheses from both statistical and theoretical perspectives. The objective is to advance scientific understanding rather than merely obtain significant p-values.

4.5.10 Running Case Study

The AI Adoption model produces the following bootstrapping results.

Hypothesis	*β*	*t*	*p*	*Decision*
H1: Performance Expectancy → AI Adoption	0.42	6.91	<0.001	Supported
H2: Trust in AI → AI Adoption	0.29	4.83	<0.001	Supported
H3: Digital Competence → AI Adoption	0.18	2.41	0.016	Supported
H4: AI Adoption → Teaching Innovation	0.55	8.74	<0.001	Supported

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The results indicate that all proposed hypotheses receive empirical support. The strongest relationship is observed between AI Adoption and Teaching Innovation, suggesting that greater adoption of AI technologies contributes substantially to innovative teaching practices. These findings support the proposed conceptual framework and provide empirical evidence consistent with the theoretical model developed in Chapter 2.

Hypothesis testing represents the stage at which empirical evidence is used to evaluate theoretical predictions. SmartPLS enables researchers to assess direct, indirect, mediating, moderating, and higher-order relationships using bootstrapping procedures. However, the objective extends beyond identifying statistically significant relationships. Researchers should interpret their findings within the broader context of scientific theory, previous literature, and practical relevance, recognizing that meaningful research contributes to the refinement and advancement of knowledge rather than simply confirming expected results.

4.6 Interpreting SmartPLS Results

Statistical analysis generates numbers, but interpretation transforms those numbers into scientific knowledge.

SmartPLS Output ⟶ Statistical Results ⟶ Interpretation ⟶ Theory Evaluation ⟶ Scientific Contribution

4.6.1 Introduction

Running a SmartPLS analysis is relatively straightforward. Modern software can estimate complex structural models within seconds and produce numerous tables, coefficients, and statistical indicators. Interpreting those results correctly is considerably more challenging. Many beginning researchers assume that once SmartPLS has produced statistically significant results, the research is complete. They often present tables of coefficients, p-values, and reliability statistics without explaining what those values actually mean.

This approach does not constitute scientific research. Statistical software produces numerical results. Researchers produce scientific interpretations. The purpose of interpretation is to explain how the statistical findings answer the research questions, evaluate the hypotheses, support or challenge the underlying theory, and contribute to existing knowledge. For this reason, interpretation is one of the most intellectually demanding stages of quantitative research.

4.6.2 Interpretation Begins with the Research Questions

Before interpreting any statistical output, researchers should return to the research questions introduced at the beginning of the study. For example, consider the following research question.
What factors influence university instructors' adoption of Artificial Intelligence technologies?
Every statistical result should contribute toward answering this question. If a reported statistic does not help answer a research question or evaluate a theoretical proposition, it probably does not belong in the discussion. Researchers should therefore organize their interpretation around:

- Research questions.
- Research objectives.
- Scientific theory.
- Research hypotheses.

Rather than around isolated statistical values. Interpretation should begin with the research questions and conclude with theory evaluation.

4.6.3 Interpreting the Measurement Model

Researchers should first interpret the measurement model before discussing structural relationships. A typical interpretation may read: The measurement model demonstrated

satisfactory reliability and validity. All indicator loadings exceeded the recommended threshold, Composite Reliability values indicated strong internal consistency, Average Variance Extracted confirmed convergent validity, and HTMT values demonstrated adequate discriminant validity. These findings suggest that the questionnaire measured the proposed constructs consistently and accurately.

Notice that this interpretation does not simply repeat numerical values. Instead, it explains what the statistics imply about measurement quality. The objective is to reassure readers that the theoretical constructs have been measured appropriately before evaluating the hypotheses.

4.6.4 Interpreting the Structural Model

Once the measurement model has been accepted, researchers interpret the structural relationships. Suppose the following result is obtained. Performance Expectancy → AI Adoption. $\beta = 0.42$; $p < 0.001$. A weak interpretation would be: The path coefficient was significant. A stronger interpretation would be: The findings indicate that instructors who believe AI technologies improve their teaching performance are more likely to adopt these technologies. This result supports the theoretical proposition proposed by UTAUT and suggests that perceived performance benefits remain one of the strongest drivers of AI adoption in higher education. The second interpretation connects the statistical finding to:

- The theory.
- The research context.
- The practical meaning.

This is what journal reviewers expect.

Table 4.9: Weak versus Strong Interpretation

Weak Interpretation	*Strong Interpretation*
The hypothesis was significant.	The results indicate that Performance Expectancy is an important determinant of AI Adoption, supporting the theoretical assumptions of UTAUT.
$R^2 = 0.61$.	The model explains 61% of the variance in AI Adoption, indicating substantial explanatory power within the higher education context.
HTMT values were acceptable.	The constructs are empirically distinct, providing evidence that each theoretical concept measures a different aspect of AI adoption.

Scientific interpretation explains the meaning of statistical results rather than merely repeating numerical values.

4.6.5 Statistical Significance versus Practical Significance

One of the most common misconceptions in quantitative research is equating statistical significance with practical importance. These concepts are related but not identical.

A statistically significant relationship indicates that the observed effect is unlikely to have occurred by chance. A practically significant relationship indicates that the effect is meaningful in real-world settings.

For example, Suppose: $\beta = 0.05$; $p < 0.001$. Although statistically significant, such a small effect may contribute very little to explaining the phenomenon. Conversely, A moderately sized effect may have substantial practical implications for educational policy, organizational decision-making, or technology implementation. Researchers should therefore discuss:

- Statistical significance.
- Effect size.
- Practical implications.

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4.6.6 Comparing Findings with Previous Research

Scientific knowledge develops through cumulative evidence. Consequently, researchers should compare their findings with previous studies. Three situations commonly occur.

Situation 1; The findings support previous research. Researchers should explain how the current study reinforces existing theoretical knowledge.

Situation 2; The findings partially agree with previous research. Researchers should discuss possible contextual differences.

Situation 3; The findings contradict previous research. Researchers should not ignore contradictory evidence.

Instead, they should provide thoughtful explanations based on:

- Cultural context.
- Sample characteristics.
- Technological developments.
- Measurement differences.
- Theoretical boundary conditions.

Unexpected findings often make valuable scientific contributions.

4.6.7 Interpreting Unsupported Hypotheses

Beginning researchers sometimes become discouraged when one or more hypotheses are not supported. In reality, unsupported hypotheses are common in high-quality research. For example, Suppose Social Influence does not significantly affect AI Adoption. Rather than writing: H3 was rejected. Researchers should ask:

- Why was this relationship not significant?
- Has technology become sufficiently mature that peer influence is less important?
- Did institutional policies reduce the importance of social pressure?
- Have previous studies reported similar findings?

Such discussion contributes to theory refinement. Scientific progress often results from explaining why theoretical expectations are not supported.

4.6.8 Evaluating the Theory

The purpose of interpretation extends beyond individual hypotheses. Researchers should evaluate the theoretical model as a whole. Consider questions such as:

- Which theoretical relationships received the strongest support?
- Which relationships were weaker than expected?
- Does the theory explain the phenomenon adequately?
- Should the conceptual framework be refined?
- Are additional constructs needed?

By answering these questions, researchers move from statistical analysis to scientific contribution. Individual statistical results collectively determine the contribution of the theory.

4.6.9 Avoiding Common Interpretation Mistakes

Several mistakes occur frequently in published research. Reporting numbers without explanation. Statistics should always be accompanied by interpretation.

Repeating SmartPLS output. Researchers should explain the meaning of the results rather than copying software tables.

Ignoring theory. Statistical findings should always be discussed in relation to the underlying theory.

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Overstating conclusions. Researchers should avoid making causal claims beyond the scope of the research design.

Ignoring practical implications. Readers want to understand why the findings matter.
Interpretation should therefore connect statistical evidence with practical applications whenever appropriate.

4.6.10 Running Case Study

The AI adoption study reports the following findings. Performance Expectancy has the strongest influence on AI Adoption. Trust in AI also demonstrates a significant positive relationship. Digital Competence contributes positively but with a smaller effect. AI Adoption strongly predicts Teaching Innovation. Rather than simply reporting these findings, the researcher interprets them as follows.

The results indicate that instructors primarily adopt AI technologies because they believe these tools improve teaching performance. Trust also plays an important role, suggesting that confidence in AI reliability remains essential for successful implementation. Although Digital Competence contributes positively, its smaller effect indicates that institutional efforts should focus not only on developing technical skills but also on demonstrating the educational value of AI technologies. This interpretation links:

- Statistical evidence.
- Scientific theory.
- Practical implications.

Together, they produce meaningful research conclusions.

Interpreting SmartPLS results is the process of transforming statistical evidence into scientific understanding. Researchers should interpret findings in relation to their research questions, hypotheses, theoretical framework, and previous literature rather than simply reporting numerical values. Effective interpretation considers statistical significance, practical importance, theoretical implications, and contextual factors. Ultimately, meaningful research contributions arise not from the software itself but from the researcher's ability to explain what the empirical evidence reveals about the phenomenon under investigation.

4.7 Reporting SmartPLS Results According to APA 7

Statistical analysis is valuable only when the results are communicated clearly and professionally.

Figure 4.8: From Analysis to Publication

4.7.1 Introduction

Completing a SmartPLS analysis does not conclude the research process. Researchers must still communicate their findings in a clear, accurate, and professional manner.
Many excellent studies are rejected by international journals not because of weak statistical analysis, but because the results are poorly reported. Common problems include presenting excessive software output, omitting important statistics, repeating the same information in text and tables, or reporting numerical values without interpretation.

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The purpose of the *Results* section is to present the empirical findings objectively. Researchers should describe what the analysis revealed without discussing why the findings occurred or what they imply for theory and practice. Those issues belong in the *Discussion* chapter or section. A well-written Results section should enable readers to understand:

- Whether the measurement model meets accepted quality standards.
- Whether the structural model supports the proposed hypotheses.
- How much variance the model explains.
- Which relationships are statistically significant.

This section explains how to organize and report SmartPLS results according to *APA 7* and the expectations of leading international journals.

4.7.2 Organizing the Results Section

A logical structure improves readability and allows reviewers to evaluate the analysis efficiently. A typical Results section follows this sequence.

1. Sample Characteristics

Briefly describe the respondents. Examples include:

- Sample size.
- Gender distribution.
- Age groups.
- Educational level.
- Professional experience.

Detailed demographic tables should be concise and relevant.

2. Measurement Model Evaluation. Present evidence for:

- Indicator reliability.
- Internal consistency reliability.
- Convergent validity.
- Discriminant validity.

Only after demonstrating acceptable measurement quality should researchers report structural model results.

3. Structural Model Evaluation. Report:

- Collinearity assessment.
- Path coefficients.
- Bootstrapping results.
- R^2 values.
- Effect sizes (f^2).
- Predictive relevance (Q^2).
- PLSpredict results (when applicable).

4. Hypothesis Testing. Conclude with a concise summary of the empirical support for each hypothesis. This sequence reflects the logical progression of PLS-SEM analysis.

4.7.3 Reporting the Measurement Model

Table 4.10: Measurement Model Assessment

Construct	*Cronbach's Alpha*	*Composite Reliability*	*AVE*
Performance Expectancy	0.88	0.92	0.75
Trust in AI	0.86	0.91	0.72
AI Adoption	0.89	0.93	0.77
Teaching Innovation	0.90	0.94	0.79

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Researchers should summarize the quality of the measurement model using concise tables. Avoid copying raw SmartPLS output directly into the manuscript. Instead, prepare publication-quality tables.

Example of reporting internal consistency reliability and convergent validity. The accompanying text might read:
All constructs demonstrated satisfactory internal consistency reliability, with Cronbach's Alpha and Composite Reliability values exceeding the recommended threshold of 0.70. Furthermore, all Average Variance Extracted (AVE) values were above 0.50, indicating adequate convergent validity. Notice that the text summarizes the findings rather than repeating every numerical value.

4.7.4 Reporting Discriminant Validity

Discriminant validity is commonly reported using the HTMT criterion. A concise table is usually sufficient.

Table 4.11: HTMT Matrix

Construct	*PE*	*Trust*	*AI Adoption*	*Teaching Innovation*
Performance Expectancy	—			
Trust in AI	0.61	—		
AI Adoption	0.72	0.69	—	
Teaching Innovation	0.48	0.54	0.79	—

All HTMT values are below the recommended threshold of 0.85, indicating satisfactory discriminant validity. The text should briefly explain the conclusion rather than reproduce every value.

4.7.5 Reporting the Structural Model

The structural model should also be summarized in one clear table.

Table 4.12: Structural Model Results

Relationship	*β*	*t-value*	*p-value*	*Decision*
PE → AI Adoption	0.42	6.91	<0.001	Supported
Trust → AI Adoption	0.29	4.83	<0.001	Supported
Digital Competence → AI Adoption	0.18	2.41	0.016	Supported
AI Adoption → Teaching Innovation	0.55	8.74	<0.001	Supported

Summary of structural relationships estimated using bootstrapping. Researchers should explain the most important findings in the text without repeating the entire table. For example:
Performance Expectancy demonstrated the strongest positive effect on AI Adoption ($\beta = 0.42$, $p < 0.001$), followed by Trust in AI ($\beta = 0.29$, $p < 0.001$). AI Adoption also exhibited a strong positive influence on Teaching Innovation ($\beta = 0.55$, $p < 0.001$).

4.7.6 Reporting Explanatory and Predictive Power

The explanatory and predictive capabilities of the model should also be reported. Example of reporting explanatory power and predictive relevance. Researchers may write:
The proposed model explained 61% of the variance in AI Adoption and 49% of the variance in Teaching Innovation. Positive Q^2 values further indicated satisfactory predictive relevance for

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both endogenous constructs. When PLSpredict has been conducted, a brief summary of its findings should also be included.

Table 4.13: Model Quality Indicators

Construct	R^2	Q^2
AI Adoption	0.61	0.39
Teaching Innovation	0.49	0.31

4.7.7 Reporting Mediation and Moderation

If the study includes mediation or moderation, separate tables improve clarity.

Example Mediation Table

Indirect Relationship	*β*	*p-value*	*Decision*
PE → AI Adoption → Teaching Innovation	0.23	<0.001	Supported

Example Moderation Table

Interaction Effect	*β*	*p-value*	*Decision*
Digital Competence × PE → AI Adoption	0.14	0.011	Supported

Separate reporting prevents confusion between direct and indirect effects.

4.7.8 APA 7 Reporting Guidelines

APA 7 encourages concise, accurate, and transparent reporting. Researchers should:

- Present tables with clear titles.
- Number tables sequentially.
- Report standardized coefficients where appropriate.
- Round numerical values consistently (usually two or three decimal places).
- Report exact p-values whenever practical (except when $p < .001$).
- Define abbreviations when first introduced.
- Avoid unnecessary decimal places.

Figures should be clear, simple, and directly relevant to the discussion. Reporting should balance precision with readability.

Table 4.14: Example of APA 7 Statistical Reporting

Correct Reporting	*Less Effective Reporting*
$\beta = 0.42$, $p < .001$	Beta equals .423987654
CR = 0.92	Composite reliability is 0.921478
AVE = 0.75	Average variance extracted equals 0.752634

4.7.9 Common Reporting Mistakes

Several mistakes frequently appear in research manuscripts. Reporting raw SmartPLS output. Researchers should prepare publication-quality tables rather than copying software output. Reporting statistics without interpretation. Every important result should be explained briefly. Repeating identical information. Avoid presenting the same numerical values in both tables and paragraphs. Tables present the evidence. The text explains the evidence.

Omitting methodological information. Readers should know:

- Sample size.
- Number of bootstrap samples.
- Decision criteria.

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- Measurement model type.

Overloading the manuscript with statistics. Report the statistics necessary to evaluate the model. Additional output can be placed in appendices when appropriate. Effective reporting focuses on communicating evidence clearly rather than reproducing software output.

4.7.10 Running Case Study

The researcher prepares the Results section for the AI Adoption study. The section follows this sequence.

1. Sample characteristics.
2. Measurement model assessment.
3. Structural model assessment.
4. Hypothesis testing.

Instead of including numerous SmartPLS screenshots, the researcher summarizes the analysis using five professionally formatted tables. The accompanying narrative explains:

- The measurement model demonstrated satisfactory reliability and validity.
- All structural relationships were statistically significant.
- The model explained a substantial proportion of the variance in AI Adoption and Teaching Innovation.
- The findings provided empirical support for the proposed theoretical framework.

The Results section is concise, transparent, and consistent with APA 7 reporting standards.

Reporting SmartPLS results is a process of communicating empirical evidence clearly, accurately, and professionally. Researchers should organize the Results section logically, present concise publication-quality tables, summarize key findings without unnecessary repetition, and follow APA 7 reporting conventions. Effective reporting allows readers and reviewers to evaluate the quality of the analysis quickly while maintaining a clear connection between the statistical evidence and the underlying research objectives.

4.8 Common Mistakes in SmartPLS Analysis

Most problems in PLS-SEM research originate before the software analysis begins.

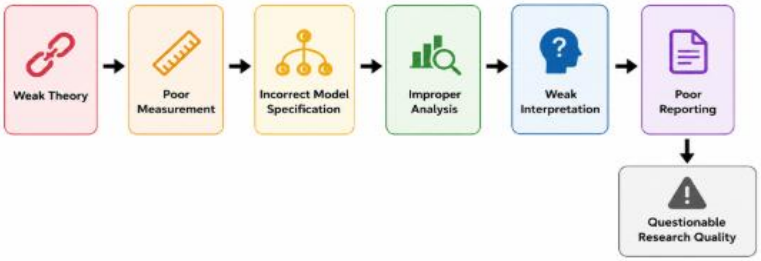

Figure 4.9: Common Sources of Error in PLS-SEM Research

4.8.1 Introduction

SmartPLS has become one of the most widely used software packages for Structural Equation Modeling because it is powerful, flexible, and relatively easy to learn. However, this accessibility sometimes creates the false impression that high-quality research can be achieved simply by importing a dataset and clicking the *Calculate* button.

This misconception has contributed to a growing number of studies with technically correct analyses but weak scientific value. The quality of a PLS-SEM study depends far more on the quality of the research design than on the software itself. Throughout this book, we have emphasized that theory should guide every stage of the research process—from identifying the research problem to interpreting the final results. The same principle applies here. Many errors

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encountered in SmartPLS are not software errors; they are *researcher errors*. Understanding these mistakes is one of the most effective ways to improve the quality of quantitative research.

4.8.2 Mistake 1: Beginning with Software Instead of Theory

Perhaps the most common mistake among beginning researchers is opening SmartPLS before developing a theoretical model. Some researchers collect data first and then attempt to discover relationships using statistical software. This approach reverses the scientific method. Theory-driven research follows the opposite sequence. Good Practice; Always develop and justify the conceptual framework before opening SmartPLS.

4.8.3 Mistake 2: Incorrectly Specifying Reflective and Formative Constructs

As discussed in Chapter 3, specifying a formative construct as reflective—or vice versa—is one of the most serious errors in PLS-SEM. This mistake affects:

- Reliability assessment.
- Validity assessment.
- Structural relationships.
- Final conclusions.

The decision should always be based on theory. Never decide the measurement model simply because one specification produces better statistical results. Good Practice; Ask the theoretical question: *Does the construct cause its indicators, or do the indicators create the construct?* The answer determines the measurement model.

4.8.4 Mistake 3: Deleting Indicators Solely to Improve Statistics

Researchers sometimes remove indicators because their outer loadings are slightly below recommended thresholds. Although indicator removal is occasionally appropriate, deleting items without theoretical justification weakens construct validity. For example, Suppose an indicator has a loading of 0.67. If the item represents an important aspect of the construct, removing it may reduce the conceptual completeness of the measurement instrument. Statistical improvement should never come at the expense of theoretical meaning. Good Practice; Evaluate both: Statistical evidence , and Theoretical importance, before removing any indicator.

4.8.5 Mistake 4: Focusing Only on p-Values

Another common mistake is treating statistical significance as the only criterion for evaluating research quality. Researchers often celebrate findings because: **$p < .05$,** without asking whether the effect is meaningful. A statistically significant relationship may have:

- A very small effect size.
- Limited explanatory power.
- Minimal practical importance.

Researchers should therefore interpret together :

- Path coefficients.
- Effect sizes (f^2).
- R^2 values.
- Predictive relevance (Q^2).
- Practical implications.

Good Practice; Never ask only: Is it significant? Also ask: Is it important?

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4.8.6 Mistake 5: Ignoring Theory When Interpreting Results

SmartPLS produces statistical evidence. Researchers produce scientific explanations. Unfortunately, many manuscripts simply describe numerical values without discussing what those values reveal about the underlying theory. For example, Writing: Performance Expectancy significantly influenced AI Adoption. is insufficient. A stronger interpretation explains:

- Why the relationship exists.
- Whether it supports previous studies.
- How it contributes to theory.
- What practical implications follow.

Good Practice; Interpret every important finding within the context of:

- Scientific theory.
- Previous literature.
- Research objectives.

4.8.7 Mistake 6: Ignoring Unsupported Hypotheses

Beginning researchers often assume that unsupported hypotheses indicate research failure.
As a result, they may:

- Ignore non-significant findings.
- Minimize discussion.
- Attempt to justify unsupported hypotheses without evidence.

This approach weakens scientific integrity. Unexpected findings frequently contribute more to knowledge than expected findings because they encourage researchers to reconsider existing theories and identify new research directions.
Good Practice; Discuss unsupported hypotheses openly and objectively. Ask:

- Why might this relationship differ from previous studies?
- What contextual factors may explain the result?
- Does the finding reveal a boundary condition of the theory?

4.8.8 Mistake 7: Reporting Excessive SmartPLS Output

SmartPLS can generate numerous tables, figures, and statistical values. Researchers sometimes include almost every output in their manuscripts. This overwhelms readers and distracts attention from the key findings. Journal reviewers expect concise reporting. Only statistics relevant to evaluating the research model should appear in the main text. Additional output may be placed in appendices if necessary. Good Practice; Report only the statistics that help readers evaluate the quality of the model and understand the research findings.

4.8.9 Mistake 8: Confusing Reliability with Validity

Reliable measurement is not necessarily valid measurement. For example, A questionnaire may produce highly consistent responses while measuring the wrong construct. Reliability answers the question: *Are the measurements consistent?*. Validity answers the question: *Are we measuring the intended construct?*. Both are required. Neither alone is sufficient. Good Practice; Always evaluate both reliability and validity before interpreting structural relationships.

4.8.10 Mistake 9: Overfitting the Model

Some researchers continually modify their models until every relationship becomes statistically significant. For example, they may:

- Add unnecessary paths.
- Remove theoretically meaningful constructs.
- Delete indicators repeatedly.
- Introduce relationships without theoretical justification.

Although these modifications may improve statistical indices, they often reduce scientific credibility. A model should represent theory—not statistical convenience. Good Practice, Model modifications should always be theoretically justified and transparently reported.

4.8.11 Mistake 10: Treating SmartPLS as an Automatic Decision-Maker

Perhaps the most important mistake is assuming that SmartPLS determines whether research is "good." The software cannot determine:

- Whether the research question is important.
- Whether the theory is appropriate.
- Whether hypotheses are meaningful.
- Whether conclusions are scientifically justified.

These decisions belong to the researcher. SmartPLS provides evidence. Researchers interpret that evidence. SmartPLS performs statistical calculations, but scientific judgment remains the responsibility of the researcher.

4.8.12 Best Practices for SmartPLS Research

Table 4.15: Common Mistakes and Recommended Solutions

Common Mistake	*Recommended Solution*
Beginning with software	Begin with theory and research questions.
Incorrect measurement model specification	Base decisions on theoretical reasoning.
Removing indicators automatically	Consider both theory and statistics.
Focusing only on p-values	Evaluate effect sizes, R^2, Q^2, and practical significance.
Reporting numbers without explanation	Interpret findings within the theoretical context.
Ignoring unsupported hypotheses	Discuss them objectively and explain possible reasons.
Including excessive software output	Report only relevant statistics.
Confusing reliability with validity	Evaluate both before testing hypotheses.
Overfitting the model	Modify models only with theoretical justification.
Relying on SmartPLS for decisions	Apply scientific judgment throughout the research process.

4.8.13 Running Case Study

The researcher reviews the AI Adoption project before preparing the manuscript.
The following checklist is completed.

✓ The conceptual framework was developed before analysis.

✓ All constructs were theoretically justified.

✓ Reflective measurement models were specified correctly.

✓ Indicator removal was based on both theory and statistical evidence.

✓ The measurement model was evaluated before the structural model.

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✓ All hypotheses, including any unsupported relationships, were reported objectively.
✓ Statistical findings were interpreted within the context of UTAUT and AI adoption research.
✓ Only essential SmartPLS output was included in the manuscript.
As a result, the study demonstrates both methodological rigor and theoretical coherence.

Most mistakes in SmartPLS research do not originate from the software but from weaknesses in research design, measurement, interpretation, and reporting. High-quality PLS-SEM studies are characterized by strong theoretical foundations, appropriate measurement models, careful statistical evaluation, transparent reporting, and thoughtful interpretation. SmartPLS is a powerful analytical tool, but meaningful scientific contributions depend on the researcher's ability to apply sound methodological principles and critical scientific reasoning throughout the research process.

4.9 Chapter Summary

Chapter 4 represented the transition from research design to empirical evaluation by demonstrating how SmartPLS is used to test theory through Partial Least Squares Structural Equation Modeling (PLS-SEM). Building on the theoretical foundations, conceptual framework, hypotheses, and measurement model developed in earlier chapters, readers learned how to transform a conceptual research model into a statistical model suitable for empirical analysis.

The chapter explained the complete SmartPLS workflow, beginning with project creation and model specification, followed by measurement model evaluation to establish reliability and validity before examining structural relationships. Readers learned how to assess path coefficients, statistical significance through bootstrapping, explanatory power (R^2), effect size (f^2), predictive relevance (Q^2), and predictive performance using PLSpredict. The chapter also emphasized that hypothesis testing should always be guided by theoretical reasoning rather than statistical significance alone.

Considerable attention was devoted to interpreting SmartPLS results and presenting them according to international publication standards. Readers learned how to prepare publication-quality tables, report empirical findings objectively, and connect statistical evidence with research questions, hypotheses, scientific theory, and previous literature. The chapter further highlighted common methodological mistakes, emphasizing that SmartPLS is a tool for evaluating theory rather than generating scientific knowledge independently.

The Artificial Intelligence Adoption in Higher Education case study illustrated the complete analytical process from validated measurement to theory evaluation. By the end of the chapter, readers had acquired the practical knowledge required to conduct a complete PLS-SEM analysis while recognizing that meaningful research depends on integrating theory, measurement, analysis, interpretation, and transparent reporting. Chapter 5 builds on this foundation by focusing on discussing findings, explaining their theoretical and practical implications, and preparing research for international publication.

4.10 Running Case Study: Continuing the AI Adoption Research Project: Analyzing the Model Using SmartPLS

In the previous chapters, the research project progressed from identifying the research problem to developing the conceptual framework, formulating hypotheses, and validating the measurement instrument. Data have now been collected from 340 university instructors, and the study is ready for empirical analysis using SmartPLS.

Step 1: Preparing the Dataset
The cleaned dataset was imported into SmartPLS after confirming that each row represented one respondent, each column represented one questionnaire item, and all variable names matched the questionnaire coding system. The study included 8 reflective constructs measured by 32 indicators using a five-point Likert scale.
Step 2: Building the Model
The conceptual framework developed in Chapter 2 was recreated in SmartPLS by defining the latent constructs, assigning their indicators, and specifying the structural relationships proposed in the research hypotheses.
Step 3: Evaluating the Measurement Model
The measurement model demonstrated satisfactory quality. Indicator loadings exceeded recommended thresholds, reliability measures confirmed internal consistency, convergent validity was established through AVE, and discriminant validity was verified using HTMT. The measurement model was therefore accepted for structural analysis.
Step 4: Evaluating the Structural Model
The structural model was assessed by examining collinearity, estimating path coefficients, performing bootstrapping, and evaluating model quality using R^2, f^2, Q^2, and PLSpredict. The results indicated satisfactory explanatory and predictive performance.
Step 5: Testing the Hypotheses
Hypothesis testing showed that all proposed relationships were statistically significant. Performance Expectancy, Trust in AI, Digital Competence, and the remaining UTAUT constructs positively influenced AI Adoption, while AI Adoption significantly enhanced Teaching Innovation.
Step 6: Interpreting and Reporting the Results
The findings were interpreted within the context of UTAUT and AI adoption research rather than relying solely on statistical significance. Finally, the researcher prepared concise APA 7 publication-quality tables summarizing the measurement model, structural model, hypothesis testing, and model quality statistics, integrating the numerical results with clear scientific interpretation.

4.11 Analytical Review & Critical Inquiry

Before moving forward, pause to evaluate the core assumptions and structural relationships introduced in this chapter

📖 A researcher reports statistically significant path coefficients but ignores R^2, f^2, and Q^2. Critically evaluate this approach.

📖 Another researcher deletes several indicators solely because their loadings are below 0.70. Do you agree with this decision? Justify your answer.

📖 A study reports excellent statistical results but provides almost no theoretical interpretation. Would this study make a strong scientific contribution? Explain your answer.

📖 Some researchers believe that learning SmartPLS is more important than understanding research methodology. Do you agree? Support your answer using examples from this chapter.

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Chapter 5

Interpreting Findings and Developing Scientific Discussion

*Chapter Purpose***:** The purpose of this chapter is to demonstrate how statistical results obtained from SmartPLS are transformed into meaningful scientific knowledge through effective interpretation and discussion. While previous chapters focused on developing the research model, collecting data, and evaluating empirical evidence, this chapter emphasizes the critical step of explaining what the findings mean and why they matter. Readers will learn how to interpret supported and unsupported hypotheses, relate findings to existing theory and previous research, identify theoretical and practical implications, acknowledge study limitations, propose future research directions, and write discussion and conclusion sections that satisfy the expectations of thesis examiners and international journal reviewers.

Chapter Learning Outcomes

After completing this chapter, readers will be able to:

1. Distinguish clearly between the Results and Discussion sections of a research study.
2. Interpret SmartPLS statistical findings within the context of scientific theory and previous literature.
3. Explain supported and unsupported hypotheses using logical, evidence-based arguments.
4. Identify theoretical, practical, and methodological implications of research findings.
5. Critically compare empirical results with previous studies and explain similarities or differences.
6. Recognize the scientific value of unexpected or non-significant findings.
7. Discuss research limitations objectively and propose meaningful directions for future research.
8. Develop clear, coherent, and publication-quality discussion and conclusion sections suitable for theses and journal articles.

Introduction

The successful completion of statistical analysis represents an important milestone in quantitative research, but it is not the final objective of a scientific study. After researchers have developed a theory-driven research model, collected data, evaluated the measurement model, and tested structural relationships using SmartPLS, the next challenge is to interpret what those statistical findings actually mean. Statistical outputs such as path coefficients, significance levels, and coefficients of determination provide evidence about relationships among constructs, but they do not explain their scientific importance. That responsibility belongs to the discussion of findings.

The discussion chapter transforms empirical evidence into scientific knowledge by interpreting results within the context of theory, previous literature, and the original research problem. Rather than simply reporting whether hypotheses were supported, researchers must explain why the observed relationships occurred, how the findings compare with earlier studies, and what new insights they contribute to existing knowledge. This distinction separates descriptive

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reporting from scientific interpretation and is one of the defining characteristics of high-quality research.
Building on the SmartPLS analyses presented in Chapter 4, this chapter demonstrates how to interpret empirical findings systematically, develop theoretical and practical implications, discuss research limitations, propose future research directions, and prepare discussion and conclusion sections suitable for dissertations and publication in international journals. Through the continuing case study on Artificial Intelligence adoption in higher education, readers will learn how meaningful scientific contributions emerge not from statistical results alone, but from thoughtful, evidence-based interpretation.

5.1 Why the Discussion Chapter Matters

Statistical analysis produces evidence, while the Discussion chapter transforms that evidence into scientific knowledge.

Research Questions
Define the problem and what you want to investigate
Data Collection
Gather data from participants or sources
Statistical Analysis
Analyze data using appropriate methods (e.g., SmartPLS)
Research Results
Obtain and report the key empirical findings
Scientific Discussion
Interpret findings, explain meaning, compare with previous studies
Knowledge Contribution
Advance theory, support practice, and guide future research

Figure 5.1: From Statistical Results to Scientific Contribution

5.1.1 Introduction

The Discussion chapter is often regarded as the most intellectually demanding part of a research project. By the time researchers begin writing this chapter, they have already completed the literature review, developed a theoretical framework, designed a measurement instrument, collected data, and analyzed the results using appropriate statistical methods. The remaining challenge is to explain what those findings actually mean.
Many beginning researchers believe that once the statistical analysis has been completed, the difficult part of the research is over. In reality, statistical analysis provides only the evidence. The Discussion chapter is where researchers demonstrate their ability to think critically, interpret evidence, and contribute to scientific knowledge.

Unlike statistical software, which performs calculations automatically, scientific discussion requires reasoning, judgment, and the ability to connect empirical findings with existing theories and previous research. For this reason, experienced journal reviewers often pay particular attention to the Discussion chapter when evaluating a manuscript. Strong statistical results alone rarely guarantee publication. What distinguishes an excellent research paper is the quality of its interpretation and its ability to explain why the findings are important.

5.1.2 The Purpose of the Discussion Chapter

The primary purpose of the Discussion chapter is to explain the meaning of the research findings.
This involves much more than describing statistical results. A well-written discussion should:

- Explain how the findings answer the research questions.
- Evaluate whether the results support the theoretical framework.
- Compare the findings with previous studies.
- Explain unexpected or contradictory results.
- Identify theoretical contributions.
- Describe practical implications.
- Acknowledge research limitations.
- Suggest directions for future research.

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The Discussion chapter therefore serves as the bridge between empirical evidence and scientific knowledge. Without interpretation, research findings remain isolated statistical observations.

5.1.3 Results versus Discussion

One of the most common mistakes made by beginning researchers is confusing the Results section with the Discussion section. Although these sections are closely related, they serve different purposes. The *Results* section presents the evidence. The *Discussion* section explains the evidence. For example: *Results;* Performance Expectancy had a positive effect on AI Adoption ($\beta = 0.42$, $p < .001$). This statement simply reports the statistical finding.

Discussion; The positive relationship between Performance Expectancy and AI Adoption suggests that university instructors are more likely to adopt AI technologies when they perceive clear improvements in teaching performance. This finding supports the theoretical assumptions of UTAUT and is consistent with previous studies that identified perceived usefulness as a major driver of technology adoption.

Notice the difference; The Results section reports *what happened*. The Discussion section explains *why it happened and why it matters.* Although closely connected, the Results and Discussion sections have different purposes and should not be combined without clear organization.

Table 5.1: Results versus Discussion

Results Section	*Discussion Section*
Reports statistical findings	Explains the meaning of the findings
Presents objective evidence	Provides interpretation and critical analysis
Focuses on numbers and statistical tests	Focuses on theory, literature, and implications
Answers "What was found?"	Answers "Why was it found?" and "Why is it important?"
Does not interpret results extensively	Interprets findings within the research context

5.1.4 The Discussion as Scientific Reasoning

Scientific research is not simply the collection of data. Its purpose is to improve understanding. The Discussion chapter demonstrates how researchers move from observation to explanation. For example, suppose a study finds that Trust in AI significantly influences AI Adoption. The statistical analysis tells us that a relationship exists. The Discussion chapter explores questions such as:

- Why does trust influence adoption?
- Which theory explains this relationship?
- Is this finding consistent with previous studies?
- What factors may strengthen or weaken this relationship?
- What practical recommendations emerge?

Answering these questions requires scientific reasoning rather than statistical calculation. The Discussion chapter therefore reflects the researcher's ability to think critically about the evidence.

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5.1.5 Returning to the Research Questions

An effective Discussion chapter is organized around the research questions introduced at the beginning of the study. Researchers should ask:

- Have the research objectives been achieved?
- Have the research questions been answered?
- What have we learned about the phenomenon being investigated?

Every major finding should contribute toward answering at least one research question. This approach creates a logical connection between the introduction, methodology, results, and discussion, ensuring that the research remains coherent from beginning to end.

Figure 5.2: Closing the Research Loop

5.1.6 Why Reviewers Focus on the Discussion

Journal reviewers often spend considerable time evaluating the Discussion chapter because it demonstrates the originality and significance of the research. Strong discussions typically:

- Explain findings clearly.
- Demonstrate understanding of theory.
- Compare findings with previous studies.
- Acknowledge limitations honestly.
- Present balanced conclusions.
- Show how the study advances knowledge.

Weak discussions often:

- Repeat the Results section.
- Ignore scientific theory.
- Overstate conclusions.
- Provide little interpretation.
- Offer vague practical implications.

Consequently, two studies with similar statistical results may receive very different publication decisions depending on the quality of their discussion.

5.1.7 Common Misconceptions

Several misconceptions frequently appear among beginning researchers. Misconception 1 *The Discussion is a repetition of the Results section.* This is incorrect. The Discussion should explain the results rather than repeat them. *Misconception 2; Only statistically significant findings should be discussed.* This is also incorrect. Unexpected or unsupported hypotheses often provide valuable theoretical insights.

Misconception 3; *The purpose of the Discussion is to prove the theory***.** Scientific research rarely proves a theory. Instead, it evaluates whether the empirical evidence supports or challenges theoretical expectations. Misconception 4; *Good statistical analysis automatically produces a good Discussion chapter.* Statistical software produces numbers. Researchers produce scientific interpretation. These are different skills.

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5.1.8 Running Case Study

The AI Adoption study produced several statistically significant relationships. The Results chapter reported that Performance Expectancy, Trust in AI, and Digital Competence positively influenced AI Adoption. The Discussion chapter now asks a different set of questions.

- Why was Performance Expectancy the strongest predictor?
- Why was Trust in AI important in the context of higher education?
- Why was the influence of Digital Competence smaller than expected?
- How do these findings compare with previous AI adoption studies?
- What do these results contribute to technology adoption theory?

The focus has shifted from reporting statistical evidence to developing scientific understanding. The Discussion chapter is where research findings become scientific knowledge. While the Results section presents empirical evidence, the Discussion explains what that evidence means, evaluates its relationship to scientific theory, compares it with previous research, identifies practical implications, and demonstrates the overall contribution of the study. A well-written Discussion chapter is therefore not a repetition of statistical results but a thoughtful interpretation that transforms empirical evidence into meaningful scientific understanding.

5.2 Interpreting Findings Through Theory

Statistical findings become scientifically meaningful only when they are interpreted within the context of an appropriate theoretical framework.

5.2.1 Introduction

One of the defining characteristics of scientific research is that findings are interpreted through *theory* rather than personal opinion. When researchers complete their statistical analysis, they obtain evidence about relationships among variables. However, these relationships become scientifically meaningful only when they are explained using the theoretical framework that guided the study.

For example, suppose a study finds that *Performance Expectancy* has a strong positive influence on *Artificial Intelligence (AI) Adoption* among university instructors. The statistical analysis tells us that the relationship exists. The theory explains *why* the relationship exists. Without theory, statistical results remain isolated observations. Theory provides the logical explanation that connects individual findings to broader scientific knowledge. For this reason, interpretation should always begin by returning to the theoretical framework introduced earlier in the research.

5.2.2 Retuning to the Theoretical Framework

Every theory-driven research project begins with one or more scientific theories. These theories explain why researchers expect certain relationships to occur. When interpreting findings, researchers should therefore ask:

- Does the evidence support the theoretical predictions?
- Which theoretical assumptions were confirmed?
- Were any assumptions challenged?
- Does the theory adequately explain the phenomenon?

Returning to the theoretical framework ensures that the discussion remains scientifically focused rather than becoming a simple description of statistical results.

5.2.3 Theory Explains the "Why"

Statistical analysis answers questions such as:

- Is the relationship significant?
- How strong is the relationship?
- How much variance does the model explain?

Theory answers different questions.

- Why does this relationship exist?

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- Why is one factor stronger than another?
- Why might the relationship differ in another context?

Consider the following example. *Result ;* Performance Expectancy positively influences AI Adoption.

Theory-Based Interpretation; According to the Unified Theory of Acceptance and Use of Technology (UTAUT), individuals are more likely to adopt a technology when they believe it will improve their performance. The present findings support this theoretical assumption by demonstrating that university instructors who perceive AI as beneficial for teaching are more willing to integrate it into their educational practice. Notice that the interpretation goes beyond reporting statistical significance. It explains the finding using scientific theory. Good discussion explains findings through theory rather than repeating statistical results.

Table 5.2: Statistical Reporting versus Theory-Driven Interpretation

Statistical Reporting	*Theory-Driven Interpretation*
Performance Expectancy significantly influenced AI Adoption ($\beta = 0.42$, $p < .001$).	The significant relationship supports UTAUT by demonstrating that perceived performance benefits encourage university instructors to adopt AI technologies in teaching.
Trust in AI was significant.	The finding suggests that confidence in AI systems is an important prerequisite for technology adoption, extending previous technology acceptance research into the educational context.

5.2.4 Theory Confirmation

Sometimes research findings support the predictions made by an existing theory. This is known as *theory confirmation*. For example, Suppose UTAUT predicts that Performance Expectancy positively influences AI Adoption. If the empirical results demonstrate a significant positive relationship, the findings provide evidence supporting that theoretical proposition. However, researchers should avoid writing: "The theory was proven". Scientific theories are rarely proven. Instead, researchers should state that:

- The findings are consistent with the theory.
- The findings support the theoretical assumptions.
- The results provide empirical evidence in favor of the proposed relationships. Theory confirmation strengthens confidence in an existing explanation but does not make the theory permanently true.

Future studies may produce different findings under different conditions.

5.2.5 Theory Extension

Research does not always stop at confirming existing theories. Sometimes researchers introduce new constructs, new relationships, or new research contexts. This process is called theory extension. For example, The original UTAUT model does not explicitly include *Trust in AI*. Suppose the researcher adds Trust in AI to the conceptual framework and finds that it significantly predicts AI Adoption.

The study has extended the theory by demonstrating that trust contributes additional explanatory power beyond the original UTAUT variables. Theory extension is particularly valuable because it expands the ability of existing theories to explain new technologies, new populations, or changing environments. New constructs and relationships can extend existing theories while maintaining their original foundations.

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Figure 5.3: Extending Existing Theory

5.2.6 Theory Refinement

Occasionally, research findings differ from theoretical expectations. Rather than viewing these differences as failures, researchers should consider whether the theory requires refinement. Theory refinement occurs when empirical evidence suggests that an existing theory does not fully explain the phenomenon under investigation. For example, Suppose Social Influence does not significantly affect AI Adoption among experienced university instructors. One possible explanation is that experienced instructors rely more on personal professional judgment than on the opinions of colleagues. In this case, the theory may remain valid, but its applicability depends on contextual factors such as professional experience. Theory refinement therefore improves scientific understanding by identifying the conditions under which theoretical relationships become stronger or weaker.

5.2.7 Avoiding Purely Statistical Interpretation

One of the most common weaknesses in student dissertations is focusing exclusively on statistical values. For example, "The path coefficient was 0.42 and the hypothesis was supported". Although factually correct, this statement contributes very little to scientific understanding. A stronger discussion might state: "The positive relationship between Performance Expectancy and AI Adoption indicates that instructors are motivated primarily by the educational benefits they expect AI technologies to provide. This finding supports UTAUT and suggests that demonstrating the instructional value of AI may encourage wider adoption within higher education."

The second example:

- Explains the finding.
- Connects it to theory.
- Provides practical meaning.

This is the purpose of scientific interpretation.

5.2.8 Integrating Multiple Theories

Some research projects are guided by more than one theory. For example,
A study of AI adoption may combine:

- UTAUT
- Technology Acceptance Model (TAM)
- Diffusion of Innovation Theory
- Trust Theory

In such cases, interpretation should explain how the theories complement one another. Researchers should avoid discussing each theory separately if the conceptual framework integrates them into a single explanatory model. Instead, the discussion should demonstrate how the findings contribute to a broader theoretical understanding of the phenomenon.

5.2.9 The Role of Theory in Scientific Contribution

The value of research depends not only on discovering statistically significant relationships but also on explaining what those relationships contribute to scientific knowledge. When interpreting findings, researchers should ask questions such as:

- Does the study confirm existing theory?
- Does it extend existing theory?
- Does it identify limitations of current theories?

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- Does it introduce new concepts or relationships?
- Does it improve our understanding of the phenomenon?

Answering these questions transforms statistical findings into genuine scientific contributions.

5.2.10 Running Case Study

The AI Adoption study found that *Performance Expectancy* was the strongest predictor of AI Adoption, followed by *Trust in AI*. From a theoretical perspective, these findings support the core assumptions of UTAUT by confirming the importance of perceived performance benefits. At the same time, the significant influence of Trust in AI extends the traditional UTAUT framework by demonstrating that confidence in AI technologies is an additional determinant of adoption in higher education. The findings therefore do more than confirm existing knowledge. They expand the theoretical explanation of AI adoption by incorporating an emerging construct that has become increasingly important as AI technologies are integrated into educational practice.

Scientific interpretation begins where statistical analysis ends. While statistical methods identify relationships among variables, theory explains why those relationships exist and what they contribute to scientific knowledge. Effective discussions therefore return to the theoretical framework, evaluate whether empirical findings confirm, extend, or refine existing theories, and demonstrate how the study advances understanding of the research problem. In theory-driven research, statistics provide the evidence, but theory provides the explanation.

5.3 Comparing Findings with Previous Literature

Scientific knowledge develops by comparing new findings with existing research rather than considering each study in isolation.

5.3.1 Introduction

Scientific research is cumulative. Every new study builds upon previous investigations, contributes additional evidence, and improves our understanding of a particular phenomenon. For this reason, researchers should never discuss their findings as though they exist independently of earlier work.

Once the statistical results have been interpreted through the theoretical framework, the next step is to compare those findings with previous studies. This comparison serves several important purposes. It helps readers determine whether the current findings:

- Support previous research.
- Extend existing knowledge.
- Challenge established assumptions.
- Reveal new insights.
- Contribute to scientific understanding.

A discussion that ignores previous literature cannot demonstrate how the study advances knowledge.

5.3.2 Why Compare Findings with Previous Studies?

Comparing findings with previous research helps researchers answer several important questions.

- Are the results consistent with earlier studies?
- Have similar relationships been reported in other countries or disciplines?
- Do the findings strengthen confidence in existing theories?
- Do they reveal differences that require further investigation?

Research rarely exists in isolation. Every finding becomes more meaningful when viewed within the broader body of scientific evidence. Comparing findings with previous research helps researchers evaluate the significance of their results.

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Figure 5.4: The Role of Literature Comparison

5.3.3 When Findings Agree with Previous Studies

One of the most common situations is that the findings support earlier research. For example, Suppose the present study finds that *Performance Expectancy positively influences AI Adoption.* Previous studies using UTAUT have reported similar results. A weak discussion might state: "This finding agrees with previous studies." Although correct, this statement provides very little scientific value.

A stronger discussion would explain: The present findings are consistent with previous studies applying UTAUT in educational technology research, which have consistently identified Performance Expectancy as one of the strongest determinants of technology adoption. This agreement strengthens confidence in the theoretical assumptions of UTAUT and suggests that perceived performance benefits remain an important factor influencing instructors' decisions to adopt AI technologies. Notice that the second example explains **why** agreement is important rather than merely stating that it exists.

5.3.4 When Findings Partially Agree with Previous Studies

Sometimes the overall findings agree with previous research, but important differences remain. For example, The present study may find that:

- Performance Expectancy has the strongest effect.
- Trust in AI has the second strongest effect.

Previous studies may also identify Performance Expectancy as important but may not include Trust in AI. This represents *partial agreement*. Researchers should explain:

- Which findings are consistent.
- Which findings differ.
- Why the differences may exist.

Possible explanations include:

- New technologies.
- Different research settings.
- Changes in user behavior.
- Different participant characteristics.

Partial agreement often leads to theory extension. Not all comparisons produce identical findings. Each situation contributes differently to scientific knowledge.

Table 5.3: Levels of Agreement with Previous Literature

Situation	*Interpretation*
Complete agreement	Findings reinforce previous evidence and strengthen confidence in existing theory.
Partial agreement	Findings support some aspects of previous research while introducing new insights or relationships.
Disagreement	Findings differ from previous studies and may indicate contextual or theoretical differences.

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5.3.5 When Findings Differ from Previous Studies

Many beginning researchers become concerned when their findings differ from earlier research. In reality, disagreement is not necessarily a weakness. Scientific progress often occurs because new evidence challenges previous assumptions. For example, Suppose previous studies found that *Social Influence significantly affects AI Adoption*, but the current study finds no significant relationship. Rather than attempting to justify the difference defensively, researchers should explore possible explanations. Examples include:

- AI technologies have become more familiar, reducing reliance on colleagues' opinions.
- University instructors may make independent professional decisions.
- Institutional policies may encourage AI adoption regardless of peer influence.
- Cultural or organizational differences may influence technology adoption behavior.

The objective is not to eliminate disagreement but to explain it logically.

5.3.6 Explaining Similarities and Differences

One of the most important skills in academic writing is explaining why findings are similar or different. Researchers should avoid simply listing studies that agree or disagree.

Instead, they should consider factors such as:

Research Context; Was the previous study conducted in schools, universities, hospitals, or businesses?

Population; Were participants students, instructors, managers, healthcare professionals, or consumers?

Technology; Did earlier studies investigate traditional information systems, online learning, or AI technologies?

Time; Technology changes rapidly. Relationships observed several years ago may differ today.

Culture; Social, organizational, and national cultures often influence human behavior. Differences across countries may therefore produce different findings. These contextual factors help explain why studies investigating similar research questions sometimes produce different results. Similar theories may produce different findings under different research conditions.

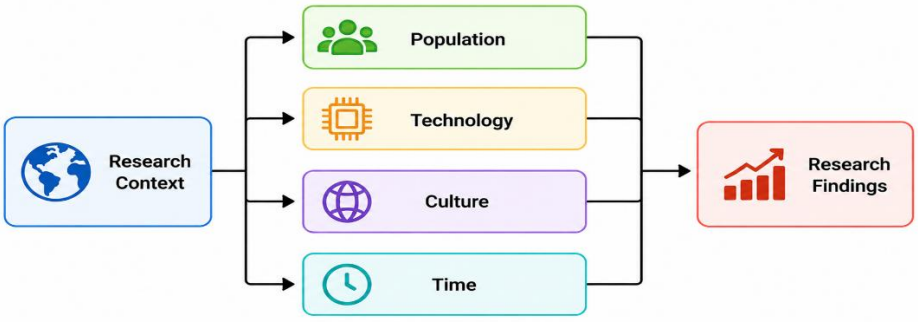

Figure 5.5: Factors Influencing Research Findings

5.3.7 Writing an Effective Literature Comparison

An effective discussion paragraph usually follows a logical structure.

Step 1, State the finding.

Step 2, Compare it with previous studies.

Step 3, Explain the similarity or difference.

Step 4, Relate the finding to theory.

Step 5, Explain its contribution.

For example: The present study found that Trust in AI positively influences AI Adoption among university instructors. This finding is consistent with recent studies examining AI implementation in higher education, which emphasize the importance of confidence in intelligent technologies. Unlike earlier technology adoption research that focused primarily on

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usefulness and ease of use, the present findings suggest that trust has become increasingly important as AI systems perform more complex educational tasks. Consequently, the study extends traditional technology acceptance models by demonstrating the growing theoretical importance of trust in AI-enabled educational environments. Notice how the paragraph moves naturally from evidence to contribution.

5.3.8 Avoiding Common Mistakes

Researchers frequently make several mistakes when comparing findings with previous literature. Listing studies without analysis. A discussion should compare findings, not simply summarize previous research. Ignoring contradictory evidence. Studies that disagree with the current findings should also be discussed objectively. Comparing every result with dozens of studies. Select the most relevant and influential research. Quality is more important than quantity. Overstating agreement. Even when findings are similar, researchers should avoid claiming that previous studies "prove" the same conclusion.

Scientific evidence is cumulative rather than absolute. Ignoring context. Always consider differences in:

- Country.
- Sample.
- Technology.
- Research design.

before drawing conclusions.

5.3.9 Running Case Study

The AI Adoption study found that Performance Expectancy was the strongest predictor of AI Adoption, consistent with many previous UTAUT studies conducted in educational technology. The study also identified Trust in AI as a significant predictor. While recent AI adoption studies have reported similar findings, earlier UTAUT research generally did not include trust as a core construct. The researcher explains that this difference reflects the increasing complexity of AI technologies. Unlike traditional software applications, AI systems make recommendations, generate content, and support decision-making. As a result, instructors must trust these systems before integrating them into their teaching. Rather than simply confirming previous research, the study extends existing technology adoption literature by highlighting the growing importance of trust in AI-based educational environments.

Comparing findings with previous literature is essential for demonstrating how a study contributes to scientific knowledge. Researchers should move beyond simply stating whether findings agree or disagree with earlier studies. Instead, they should explain the reasons for similarities and differences by considering theory, research context, participant characteristics, technological developments, and cultural influences. A thoughtful comparison not only strengthens the discussion but also shows how the current study confirms, extends, or refines existing knowledge.

5.4 Discussing Supported and Unsupported Hypotheses

Whether a hypothesis is supported or not, every result provides an opportunity for scientific discussion.

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Figure 5.6: From Hypothesis Testing to Scientific Discussion

5.4.1 Introduction

After completing the statistical analysis presented in Chapter 4, researchers know which hypotheses are supported by the empirical data and which are not. However, identifying statistical significance is only the beginning of the discussion process. The real challenge is explaining *why* the results occurred. Many beginning researchers mistakenly believe that supported hypotheses require discussion while unsupported hypotheses should be mentioned briefly or ignored altogether. This approach weakens the scientific quality of the research.

Every hypothesis—whether supported or unsupported—contributes to scientific knowledge. Supported hypotheses strengthen confidence in theoretical predictions, whereas unsupported hypotheses encourage researchers to reconsider theoretical assumptions, identify contextual influences, or propose new directions for future research. A high-quality discussion therefore treats every hypothesis as an opportunity to improve scientific understanding.

5.4.2 Discussing Supported Hypotheses

When a hypothesis is supported, researchers should do more than report statistical significance. A complete discussion should answer four questions:

1. What was found?
2. Why was this relationship expected according to theory?
3. How does the finding compare with previous research?
4. What does this result contribute to scientific knowledge or practice?

For example, Suppose the following hypothesis is supported.

*H1***:** Performance Expectancy positively influences AI Adoption. A weak discussion would be: H1 was supported because the path coefficient was significant. A stronger discussion would be: The findings indicate that Performance Expectancy is a major determinant of AI Adoption among university instructors. This result supports the assumptions of the Unified Theory of Acceptance and Use of Technology (UTAUT), which proposes that individuals are more likely to adopt a technology when they believe it will improve their performance. The finding is also consistent with previous studies in educational technology, suggesting that perceived benefits remain one of the strongest drivers of technology adoption. From a practical perspective, universities should demonstrate the educational value of AI tools to encourage their adoption among academic staff. Notice that the discussion moves beyond statistics to theory, previous literature, and practical implications. A complete discussion connects empirical findings with theory, previous literature, and practical implications.

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5.4.3 Discussing Unsupported Hypotheses

Unsupported hypotheses are a normal part of scientific research. A non-significant relationship does **not** mean that the study has failed. Instead, it indicates that the proposed theoretical relationship was not supported under the specific conditions of the study. Researchers should discuss unsupported hypotheses objectively and explore possible explanations. For example, Suppose the following hypothesis is not supported. *H4***:** Social Influence positively influences AI Adoption. Rather than writing: H4 was rejected.

Researchers should write: The relationship between Social Influence and AI Adoption was not statistically significant. One possible explanation is that university instructors make technology decisions independently based on professional judgment rather than peer influence. Another explanation may be the increasing maturity of AI technologies, which has reduced the importance of social pressure compared with earlier stages of technology adoption. Similar findings have been reported in recent studies involving experienced technology users, suggesting that the influence of colleagues decreases as familiarity with emerging technologies increases. This approach contributes much more to scientific knowledge.

5.4.4 Why Do Hypotheses Sometimes Differ from Expectations?

Research findings do not always match theoretical predictions. Several factors may explain these differences. Research Context; Relationships observed in one setting may not appear in another. Sample Characteristics; Students, instructors, managers, and consumers often behave differently.

Technological Change; Rapid technological developments may alter user behavior over time. Cultural Differences; National and organizational cultures may influence attitudes and decision-making. Measurement Issues; Differences in questionnaire design or construct operationalization may affect empirical results. Emerging Phenomena; New technologies such as Artificial Intelligence may introduce relationships that are not fully explained by existing theories. Researchers should evaluate these possibilities before concluding that a theory is inadequate.

Table 5.4: Possible Reasons for Unsupported Hypotheses

Possible Reason	*Example*
Different research context	Universities instead of commercial organizations
Different participants	Academic staff instead of students
Technological maturity	AI technologies have become more familiar
Cultural influences	Different organizational or national cultures
Measurement differences	Alternative questionnaire items
Theoretical limitations	Existing theory may not fully explain the phenomenon

Unsupported hypotheses often provide opportunities for theory refinement rather than indicating research failure.

5.4.5 Avoiding Defensive Writing

Beginning researchers sometimes become defensive when discussing unsupported hypotheses. Common reactions include:

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- Ignoring the finding.
- Suggesting that the software produced incorrect results.
- Blaming the sample without evidence.
- Attempting to justify the hypothesis despite contradictory evidence.

These approaches reduce scientific credibility. Instead, researchers should remain objective. Scientific discussion should focus on understanding the findings rather than defending personal expectations. Unexpected results often provide the most interesting opportunities for scientific discovery.

5.4.6 Balancing Statistical and Theoretical Interpretation

Supported hypotheses should not be discussed solely because they are statistically significant. Similarly, unsupported hypotheses should not be dismissed simply because they are non-significant. Researchers should evaluate every hypothesis from two perspectives. Statistical Perspective; Was the relationship statistically supported?. Theoretical Perspective; What does the finding tell us about the theory?. For example, A non-significant relationship may suggest that:

- The theoretical relationship is context-dependent.
- Another construct may mediate the relationship.
- Existing theories require refinement.

This perspective transforms statistical outcomes into scientific insights.

5.4.7 Writing a Discussion Paragraph

A practical way to discuss each hypothesis is to follow a consistent structure.
Step 1: State the finding.
Step 2: Explain the finding using theory.
Step 3: Compare it with previous studies.
Step 4: Explain possible reasons.
Step 5: Discuss its contribution or practical implication.
This structure helps researchers produce discussions that are logical, coherent, and publication-ready.

5.4.8 Avoiding Common Mistakes

Researchers should avoid several common errors such as : Repeating statistical values; The Results section already reports numerical findings. The Discussion should explain their meaning. Ignoring unsupported hypotheses; Every hypothesis deserves discussion. Overstating conclusions; Avoid claiming that a hypothesis "proves" a theory. Ignoring contradictory literature; Balanced discussions acknowledge both supporting and opposing evidence. Focusing only on significance; Interpret effect sizes, theoretical implications, and practical relevance as well.

5.4.9 Running Case Study

The AI Adoption study produced seven hypotheses. Six hypotheses were strongly supported, while one relationship between Social Influence and AI Adoption was weaker than expected. Rather than viewing this finding as a weakness, the researcher explored possible explanations.

The discussion suggested that experienced university instructors rely primarily on perceived educational benefits and trust in AI rather than the opinions of colleagues. This interpretation reflects the changing nature of technology adoption in higher education, where professional autonomy may reduce the influence of social pressure. Consequently, the unsupported

hypothesis contributed to refining the understanding of AI adoption rather than weakening the overall study.

Discussing hypotheses is far more than reporting whether they were supported. Each hypothesis should be interpreted within the context of scientific theory, previous research, and the specific characteristics of the study. Supported hypotheses reinforce or extend existing knowledge, while unsupported hypotheses often reveal important contextual influences or theoretical limitations. A balanced and objective discussion of both types of findings demonstrates scientific maturity and strengthens the overall contribution of the research.

5.5 Developing Theoretical Contributions

A theoretical contribution is created by interpreting research findings in a way that improves scientific understanding.

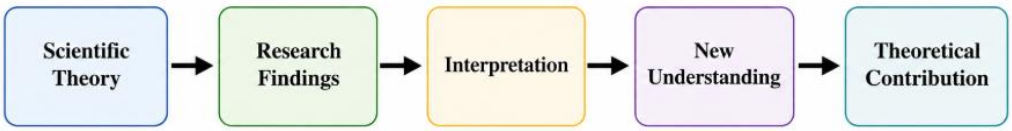

Figure 5.7: From Research Findings to Theoretical Contribution

5.5.1 Introduction

One of the first questions asked by thesis examiners, journal reviewers, and editors is: *"What does this study contribute to theory?"*. Many beginning researchers find this question difficult because they believe that only famous scientists develop theories. Consequently, they assume that their own research cannot make a theoretical contribution. This is a misunderstanding. A theoretical contribution does *not* require inventing an entirely new theory.

Most published research contributes to theory in much smaller but equally valuable ways. A study may confirm an existing theory in a new context, extend a theory by introducing additional constructs, refine theoretical relationships, or identify conditions under which a theory performs better or worse. The objective is not to replace existing theories but to improve scientific understanding.

5.5.2 What Is a Theoretical Contribution?

A theoretical contribution is any research finding that improves our understanding of a phenomenon by supporting, extending, refining, integrating, or questioning an existing theory. In simple terms, A theoretical contribution answers the question: "What have we learned about the theory because of this study?". The emphasis is on knowledge rather than statistics.

For example, Suppose a study finds that *Trust in AI* significantly influences AI Adoption. The statistical result is: Trust positively influences AI Adoption. The theoretical contribution is: The findings suggest that trust should be considered an important extension of traditional technology adoption theories when investigating Artificial Intelligence in higher education. Notice the difference. The first statement reports a finding. The second explains its contribution to scientific knowledge. Research findings become theoretical contributions through thoughtful interpretation.

5.5.3 Types of Theoretical Contributions

Not every study contributes in the same way. Several forms of theoretical contribution are common in academic research.

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A. Theory Confirmation; The simplest contribution occurs when research provides additional evidence supporting an existing theory. For example, The present study confirms the prediction of UTAUT that Performance Expectancy positively influences technology adoption. Although confirmation may appear modest, repeated evidence from different contexts strengthens confidence in scientific theories.

B. Theory Extension; A study extends theory by introducing new constructs, relationships, or research contexts. For example, The original UTAUT model does not explicitly include *Trust in AI.* Adding this construct and demonstrating its importance extends the explanatory power of the theory.

C. Theory Refinement; Sometimes empirical findings suggest that a theory requires modification. For example, Suppose Social Influence is not significant among experienced university instructors. Rather than rejecting the theory completely, the findings may indicate that the influence of Social Influence decreases as users gain professional experience. This refines the theory by identifying a possible boundary condition.

D. Theory Integration; Some studies combine concepts from two or more theories. For example, A researcher may integrate:

- UTAUT
- Technology Acceptance Model (TAM)
- Trust Theory

to develop a more comprehensive explanation of AI adoption. If the integrated model performs better than the individual theories, the study contributes to theoretical integration. Most research contributes by confirming, extending, refining, or integrating existing theories.

Table 5.5: Types of Theoretical Contributions

Type	*Description*	*Example*
Theory Confirmation	Supports an existing theory	Confirms that Performance Expectancy predicts AI Adoption
Theory Extension	Adds new constructs or relationships	Introduces Trust in AI into UTAUT
Theory Refinement	Improves understanding of existing relationships	Shows that Social Influence depends on professional experience
Theory Integration	Combines multiple theories	Integrates UTAUT and Trust Theory

5.5.4 Moving Beyond Statistical Significance

One of the most common mistakes made by beginning researchers is assuming that statistically significant results automatically represent theoretical contributions. This is incorrect. Statistical significance indicates that a relationship is unlikely to have occurred by chance. A theoretical contribution explains *why that relationship matters* for scientific understanding. For example, A researcher may report: Performance Expectancy significantly influenced AI Adoption. This is a statistical finding. A stronger discussion would state: The findings reinforce UTAUT by demonstrating that perceived performance benefits remain the strongest determinant of AI Adoption among university instructors. Furthermore, the study shows that this relationship continues to hold in AI-supported educational environments, thereby extending previous

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technology adoption research into a rapidly evolving technological context. The second statement explains the contribution rather than merely reporting the result.

5.5.5 Writing a Strong Theoretical Contribution

A practical structure for writing theoretical contributions is shown below.
Step 1; State the major finding.
Step 2; Identify the relevant theory.
Step 3; Explain how the finding relates to that theory.
Step 4; Describe what new understanding has been gained.
Step 5; Explain why this contribution is important.
Following this structure helps researchers produce discussions that are logical, persuasive, and scientifically meaningful.

5.5.6 Avoiding Overstated Claims

Researchers should avoid making exaggerated claims. Statements such as:

- "This study proves the theory."
- "This research completely changes the field."
- "A new theory has been developed."

are rarely justified. Instead, use balanced academic language. Examples include:

- "The findings provide additional support for..."
- "The study extends previous research by..."
- "The results suggest that..."
- "The evidence indicates that..."
- "The findings contribute to a better understanding of..."

Balanced writing improves scientific credibility.

5.5.7 Theoretical Contribution versus Practical Contribution

Students often confuse theoretical and practical contributions. They are related but different. A theoretical contribution improves scientific understanding. A practical contribution improves professional practice. For example, Finding: Trust in AI influences AI Adoption. Theoretical contribution: The findings extend technology adoption theory by identifying trust as an important determinant of AI adoption in higher education. Practical contribution: Universities should strengthen instructors' confidence in AI technologies through training, transparency, and ethical implementation strategies. Both contributions are valuable, but they answer different questions. High-quality research usually includes both theoretical and practical contributions.

Table 5.6: Theoretical versus Practical Contribution

Theoretical Contribution	*Practical Contribution*
Advances scientific knowledge	Improves professional practice
Relates findings to theory	Relates findings to real-world application
Addresses researchers	Addresses practitioners and decision-makers
Explains why relationships exist	Explains how findings can be applied

5.5.8 Demonstrating Contribution in Journal Articles

International journals expect researchers to explain clearly how their studies contribute to existing knowledge. Authors should answer questions such as:

- What gap does this study address?

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- How do the findings improve current theory?
- What new understanding has emerged?
- Why should other researchers care about these findings?

If these questions cannot be answered clearly, reviewers may conclude that the study offers limited originality. A strong theoretical contribution therefore increases both the academic value of the research and its likelihood of publication.

5.5.9 Running Case Study

The AI Adoption study confirmed that *Performance Expectancy* remains the strongest predictor of AI Adoption, supporting the core assumptions of UTAUT. However, the study also found that *Trust in AI* significantly influenced adoption decisions. This finding extends traditional technology adoption theory by demonstrating that trust has become increasingly important in AI-enabled educational environments, where intelligent systems actively support teaching, assessment, and decision-making. The theoretical contribution is therefore not simply that trust is significant. Rather, the study shows that technology adoption theories should increasingly consider trust when explaining the acceptance of intelligent technologies in higher education.

A theoretical contribution is the scientific value that emerges when empirical findings improve our understanding of an existing theory or phenomenon. Most studies contribute by confirming, extending, refining, or integrating existing theories rather than creating entirely new ones. Effective researchers move beyond reporting statistically significant relationships to explain how their findings advance scientific knowledge. By connecting empirical evidence with theoretical understanding, they demonstrate the originality and significance of their research and strengthen its potential for publication in high-quality academic journals.

5.6 Developing Practical Implications

Practical implications transform research findings into actions that improve professional practice.

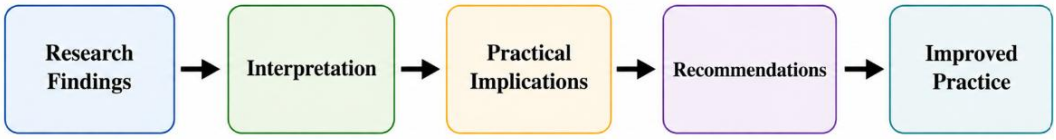

Figure 5.8: From Research Findings to Practical Action

5.6.1 Introduction

Scientific research is conducted not only to increase knowledge but also to improve practice. While theoretical contributions explain how research advances scientific understanding, practical implications explain how research findings can be applied to solve real-world problems.

Many beginning researchers believe that practical implications consist of a short list of recommendations placed at the end of the Discussion chapter. In reality, practical implications should be developed directly from the empirical findings and should demonstrate how the study can benefit organizations, professionals, policymakers, educators, industry, or society. Practical implications should always answer one important question: *"If these findings are correct, what should people do differently?"*. The answer should be supported by evidence from the study rather than by personal opinion.

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5.6.2 What Are Practical Implications?

Practical implications are evidence-based recommendations that show how research findings can improve decisions, policies, processes, or professional practice. Unlike theoretical contributions, which are directed toward researchers, practical implications are directed toward individuals and organizations that can apply the findings. Depending on the research topic, practical implications may target:

- Managers.
- Teachers and educators.
- Healthcare professionals.
- Government agencies.
- Business organizations.
- Technology developers.
- Community organizations.

The recommendations should be realistic, achievable, and directly supported by the research results.

5.6.3 Developing Evidence-Based Recommendations

One of the most common mistakes made by students is writing recommendations that are unrelated to their findings. For example, Suppose a study finds that *Performance Expectancy* strongly influences AI Adoption. A weak recommendation would be: Universities should purchase more computers. This recommendation is not directly supported by the findings.

A stronger recommendation would be: Universities should demonstrate how AI technologies improve teaching effectiveness by providing practical workshops, classroom examples, and evidence of successful educational applications. Increasing instructors' awareness of the educational benefits of AI may strengthen their willingness to adopt these technologies. The recommendation is directly linked to the empirical evidence. This makes it more persuasive and scientifically credible.

5.6.4 Identifying the Target Audience

Different research findings may have implications for different groups. Researchers should identify the audience that will benefit from the study. Examples include: Educational Institutions; Improving teaching practices, curriculum design, digital learning strategies, or professional development. Organizational Leaders; Supporting strategic planning, innovation, employee training, or technology implementation. Policymakers; Developing regulations, educational policies, or national technology strategies. Software Developers; Designing systems that better meet user needs and expectations. Researchers; Identifying new research questions and improving theoretical models. Recognizing the appropriate audience helps researchers write recommendations that are relevant and practical. Practical implications should emerge directly from the research findings.

Table 5.7: Examples of Practical Implications

Research Finding	*Practical Implication*
Performance Expectancy strongly predicts AI Adoption.	Demonstrate the educational benefits of AI through training and classroom demonstrations.
Trust in AI positively influences adoption.	Develop transparent AI policies and provide guidance on ethical AI use.

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Research Finding	*Practical Implication*
Digital Competence influences adoption.	Offer continuous professional development in AI literacy and digital skills.
Facilitating Conditions affect adoption.	Improve institutional technical support and digital infrastructure.

5.6.5 Writing Effective Practical Implications

An effective practical implication usually follows four steps.
Step 1; Identify the research finding.
Step 2; Identify the stakeholder.
Step 3; Explain the recommended action.
Step 4; Explain the expected benefit.
For example, The findings indicate that Trust in AI significantly influences AI Adoption among university instructors. Therefore, university administrators should establish clear institutional guidelines regarding the ethical and responsible use of AI technologies. Providing transparent policies and professional support may increase instructors' confidence in AI systems and encourage their integration into teaching and learning activities. Notice that the recommendation:

- Is based on the findings.
- Identifies the responsible stakeholder.
- Recommends a realistic action.
- Explains the expected outcome.

Practical implications should connect research evidence with specific actions and measurable benefits.

5.6.6 Avoiding Unrealistic Recommendations

Recommendations should be practical and achievable. Researchers should avoid suggestions that:

- Require resources beyond the scope of the study.
- Are unrelated to the findings.
- Depend on evidence not collected during the research.
- Promise unrealistic outcomes.

For example, Suppose a study involves one university. It would be inappropriate to recommend: Governments worldwide should completely redesign national education systems. Such a recommendation extends far beyond the available evidence. Instead, recommendations should remain proportional to the scope of the research.

5.6.7 Practical Implications in Different Research Fields

Although the general principles remain the same, practical implications vary across disciplines. Education; Recommendations may focus on:

- Curriculum development.
- Teacher training.
- Student learning.
- Educational technology.

Business; Recommendations may address:

- Customer satisfaction.
- Digital transformation.

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- Employee performance.
- Organizational strategy.

Healthcare; Recommendations may involve:

- Patient care.
- Clinical decision-making.
- Health information systems.
- Public health policies.

Information Technology; Recommendations may include:

- System design.
- User experience.
- Cybersecurity.
- AI implementation.
- Digital governance.

Researchers should adapt their recommendations to the specific needs of their discipline.

5.6.8 Balancing Evidence and Interpretation

Practical implications should always be supported by empirical evidence. Researchers should avoid presenting personal opinions as research recommendations. Consider the following comparison.

*Opinion***;** AI should be used everywhere in education.

*Evidence-Based Recommendation***;** Because Performance Expectancy significantly influenced AI Adoption, universities should emphasize the educational value of AI technologies through professional development programs that demonstrate practical classroom applications. The second recommendation is clearly supported by the findings. Strong recommendations are specific, evidence-based, and linked directly to the research findings.

Table 5.8: Weak versus Strong Practical Implications

Weak Practical Implication	*Strong Practical Implication*
Universities should use AI.	Universities should provide structured training that demonstrates how AI improves teaching effectiveness because Performance Expectancy was the strongest predictor of AI Adoption.
Teachers need more technology.	Institutions should strengthen instructors' digital competence through continuous AI-focused professional development.
Organizations should change.	Organizations should improve technical support and digital infrastructure to strengthen facilitating conditions for AI adoption.

5.6.9 Practical Implications for the AI Adoption Study

The findings of the AI Adoption study provide several practical implications. First, universities should demonstrate the educational benefits of AI technologies through practical workshops, pilot projects, and examples of successful classroom implementation. Since Performance Expectancy emerged as the strongest predictor of AI Adoption, increasing awareness of AI's instructional value is likely to encourage greater adoption.

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Second, institutions should establish clear policies addressing the ethical and responsible use of AI. The significant influence of Trust in AI suggests that instructors are more willing to adopt AI technologies when they believe these systems are reliable, transparent, and used responsibly.

Third, universities should invest in continuous professional development programs that improve instructors' digital competence. Although Digital Competence was not the strongest predictor, it remained a significant factor influencing AI Adoption. Finally, university leaders should strengthen institutional support by improving digital infrastructure, technical assistance, and access to AI-based educational tools. Together, these recommendations provide practical guidance for educational institutions seeking to integrate AI effectively into teaching and learning.

5.6.10 Running Case Study

After interpreting the SmartPLS results, the researcher developed practical implications for three stakeholder groups. *University Administrators*; Strengthen institutional AI strategies, improve infrastructure, and provide technical support. *Academic Staff;* Participate in professional development programs that demonstrate effective AI-supported teaching practices. *Educational Policymakers;* Develop national guidelines for the ethical, responsible, and effective integration of AI into higher education. Each recommendation was based directly on the empirical findings rather than personal opinion, ensuring that the practical implications remained evidence-based and scientifically justified.

Practical implications translate research findings into meaningful actions that improve professional practice and decision-making. Unlike theoretical contributions, which advance scientific knowledge, practical implications help organizations, practitioners, and policymakers apply research evidence to real-world problems. Effective recommendations are evidence-based, directed toward specific stakeholders, realistic, and clearly connected to the empirical findings. When developed thoughtfully, practical implications demonstrate the real-world value of scientific research and strengthen its overall impact.

5.7 Identifying Research Limitations

Research limitations help readers understand the boundaries of a study and provide direction for future investigations.

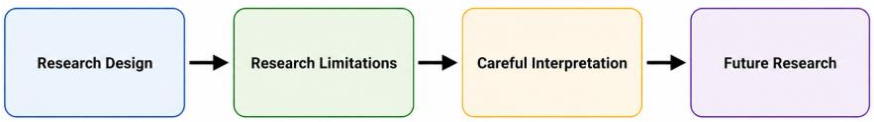

Figure 5.9: The Role of Research Limitations

5.7.1 Introduction

No research study is perfect. Every research project is conducted within practical constraints such as time, resources, access to participants, research design, and available measurement instruments. These constraints influence the scope of the study and define the conditions under which the findings should be interpreted. For this reason, researchers are expected to discuss the limitations of their work honestly and objectively.

Many beginning researchers worry that acknowledging limitations will reduce the value of their study. As a result, they either ignore limitations completely or attempt to minimize them. In reality, the opposite is true. A balanced discussion of research limitations demonstrates scientific integrity, critical thinking, and an understanding of the boundaries of the research.

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Journal reviewers and thesis examiners generally expect researchers to recognize the limitations of their studies and explain how these limitations affect the interpretation of the findings. The purpose of this section is not to criticize the research but to clarify what the study can and cannot conclude.

5.7.2 What Is a Research Limitation?

A *research limitation* is a condition or constraint that may influence the interpretation, generalization, or application of the research findings. Limitations do not necessarily indicate mistakes. Instead, they define the scope within which the results should be understood. For example, a study conducted at one university may provide valuable insights into AI adoption in higher education. However, the findings should not automatically be generalized to every university, country, or educational system. Recognizing such boundaries improves the credibility of the research.

5.7.3 Common Types of Research Limitations

Research limitations may arise from several sources. The most common categories are described below.

A. Sample Limitations; The characteristics of the sample may restrict the generalizability of the findings. Examples include:

- Small sample size.
- Participants from a single organization.
- Limited geographical coverage.
- Specific age groups.
- Specific professional groups.

For example, A study involving only university instructors cannot automatically represent school teachers, students, or business professionals.

B. Methodological Limitations; The selected research method may influence the findings. Examples include:

- Cross-sectional research design.
- Self-reported questionnaires.
- Quantitative methods only.
- Online data collection.

Each methodological choice offers advantages but also introduces certain limitations.

C. Measurement Limitations; Research findings depend on the quality of the measurement instrument. Possible limitations include:

- Limited questionnaire items.
- Newly developed constructs.
- Subjective perceptions.
- Restricted measurement scales.

Researchers should acknowledge these issues while explaining how validity and reliability were established.

D. Contextual Limitations; Research findings are often influenced by the environment in which the study was conducted. Examples include:

- Country.
- Organization.
- Industry.

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- Educational system.
- Technology level.

A model that explains AI adoption in one country may not perform identically in another cultural or organizational context.

E. Time Limitations; Many studies collect data at a single point in time. As technology, organizations, and society evolve, relationships among variables may also change. Longitudinal studies may therefore produce different results. Most research studies include several types of limitations that should be acknowledged and discussed.

Table 5.9: Common Categories of Research Limitations

Limitation Type	*Example*
Sample	Participants from one university
Methodology	Cross-sectional survey design
Measurement	Self-reported questionnaire responses
Context	Conducted within one country
Time	Data collected during one academic semester

5.7.4 Writing About Limitations Objectively

Researchers should discuss limitations honestly without undermining the value of the study. Consider the following examples. *Weak Statement***;** The study has many weaknesses. This statement is vague and unnecessarily negative. A stronger statement would be: The findings should be interpreted in light of the study's scope. Because the sample consisted of university instructors from one educational context, caution should be exercised when generalizing the findings to other sectors or countries. The second statement is objective, specific, and balanced.

5.7.5 Limitations versus Weaknesses

Students often use the terms limitation and weakness interchangeably. Although related, they are not identical. A limitation is an expected boundary of the research. A weakness usually refers to a problem that could have been avoided. For example, Collecting data from one university because of the study's objectives may represent a limitation. Failing to test questionnaire reliability would represent a methodological weakness. Researchers should focus primarily on discussing legitimate limitations rather than criticizing avoidable mistakes.

5.7.6 Linking Limitations to Future Research

An effective limitations section naturally leads to future research. For example, Because the study focused on university instructors, future research may examine AI adoption among school teachers, students, or educational administrators. Similarly, Because the research employed a cross-sectional design, future studies may adopt longitudinal approaches to examine changes in AI adoption over time. This approach transforms limitations into opportunities for scientific advancement.

5.7.7 Avoiding Common Mistakes

Researchers should avoid several common errors. Claiming that the study has no limitations. Every study has limitations. Such claims reduce credibility. Listing too many minor limitations.

Focus on limitations that genuinely influence the interpretation of the findings. Apologizing for the research. Researchers should acknowledge limitations objectively rather than defensively.

Confusing limitations with mistakes. Expected research boundaries are not methodological failures.

Introducing new results. The limitations section should discuss the scope of the study rather than present additional findings.

Table 5.10: Weak versus Strong Limitation Statements

Weak Statement	*Strong Statement*
The sample was small.	Because the study involved instructors from one university, the findings should be generalized cautiously to other educational settings.
More research is needed.	Future studies should examine AI adoption across different countries and educational systems to evaluate the generalizability of the proposed model.
The questionnaire may not be accurate.	Although reliability and validity were established, future research may further refine the measurement instrument by incorporating additional indicators.

5.7.8 Limitations in the AI Adoption Study

The AI Adoption study acknowledged several limitations. First, the research focused on university instructors within one higher education context. Although the findings provide valuable insights, they may not represent other educational sectors. Second, the study employed a cross-sectional survey design. Consequently, causal relationships should be interpreted carefully, and future longitudinal research may provide additional evidence regarding changes in AI adoption over time.

Third, the data were collected using self-reported questionnaires. Although the measurement model demonstrated satisfactory reliability and validity, future studies could combine survey data with interviews, classroom observations, or institutional records to provide a more comprehensive understanding of AI adoption. Recognizing these limitations does not reduce the value of the study. Instead, it defines the conditions under which the findings should be interpreted and provides a foundation for future research.

5.7.9 Running Case Study

At the end of the AI Adoption project, the researcher included a dedicated section discussing the study's limitations. Rather than presenting a list of weaknesses, the researcher explained the boundaries of the research design. The discussion acknowledged that the sample represented university instructors within a specific educational context, the study relied on cross-sectional survey data, and the findings reflected perceptions measured at a single point in time.

The researcher then proposed future studies involving different educational levels, additional countries, and longitudinal research designs. As a result, the limitations section strengthened rather than weakened the scientific quality of the study.

Research limitations are an essential part of scientific reporting because they define the scope and boundaries of a study. Rather than weakening research, honest discussion of limitations

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demonstrates transparency, critical thinking, and methodological awareness. Researchers should distinguish between expected research boundaries and avoidable weaknesses, explain how limitations influence the interpretation of findings, and use them to identify meaningful directions for future research. Well-written limitation sections enhance both the credibility and the scientific value of a research project.

5.8 Developing Future Research Directions

Every research study provides a foundation for future investigations and continued scientific development.

Figure 5.10: Research as a Continuous Process

5.8.1 Introduction

Scientific research is never completely finished. Every study answers some questions while creating new ones. As researchers interpret their findings and recognize the limitations of their work, they also identify opportunities for future investigations that can deepen scientific understanding. For this reason, most dissertations, theses, and journal articles conclude the Discussion chapter by proposing future research directions.

These recommendations are not intended simply to satisfy academic writing requirements. Instead, they demonstrate that researchers understand the broader scientific context of their work and recognize that knowledge develops through continuous investigation. Future research recommendations should therefore be based on evidence rather than personal opinion. They should answer the following question: *"Based on the findings and limitations of this study, what should future researchers investigate?"*

5.8.2 Why Future Research Is Important

No single study can explain every aspect of a complex phenomenon. Different researchers examine different populations, use different methods, investigate new technologies, and test alternative theoretical models. Future research therefore serves several purposes. It helps researchers:

- Verify existing findings.
- Test theories in new contexts.
- Improve measurement instruments.
- Investigate additional variables.
- Explore emerging technologies.
- Strengthen scientific knowledge.

Each new study contributes another piece to the larger scientific picture.

5.8.3 Sources of Future Research Ideas

Meaningful future research directions often emerge naturally from the current study. Researchers should consider several sources.

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A. Research Limitations; Many future studies are suggested by the limitations discussed in the previous section. For example, If the current study examined one university, future studies may investigate multiple universities or different countries.

B. Unexpected Findings; Unsupported hypotheses or unexpected relationships frequently create opportunities for further investigation. Researchers may wish to examine why these findings occurred under different conditions.

C. New Technologies; Rapid technological change creates new research opportunities. For example, Future studies may investigate:

- Generative Artificial Intelligence.
- Intelligent tutoring systems.
- AI-assisted assessment.
- Human-AI collaboration.

D. Emerging Social Issues; Changes in education, business, healthcare, and society often create new research questions. Examples include:

- AI ethics.
- Digital inclusion.
- Data privacy.
- Responsible innovation.

Table 5.11: Sources of Future Research

Source	*Example*
Research limitations	Extend the study to multiple universities
Unexpected findings	Investigate why Social Influence was not significant
New technologies	Examine Generative AI adoption
New populations	Study students, administrators, or school teachers
New theories	Integrate additional theoretical frameworks

5.8.4 Extending the Research Context

One common approach is to investigate the same research model in a different context. Possible extensions include:

- Different countries.
- Different educational systems.
- Different industries.
- Public versus private organizations.
- Small versus large organizations.

Comparing different contexts helps researchers determine whether theoretical relationships remain stable across environments.

5.8.5 Studying Different Populations

Research findings often depend on the characteristics of the participants. Future studies may therefore investigate:

- Students.
- School teachers.
- University administrators.
- Healthcare professionals.

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- Government employees.
- Business managers.

Examining different populations helps evaluate the generalizability of the theoretical model.

5.8.6 Improving the Research Model

Future studies may also improve the conceptual framework itself. Possible improvements include:

- Adding new constructs.
- Introducing mediating variables.
- Examining moderating variables.
- Comparing competing theoretical models.
- Developing higher-order constructs.

Such extensions may improve the explanatory or predictive power of the research model.

5.8.7 Using Alternative Research Methods

Future research is not limited to collecting additional questionnaire data. Researchers may adopt alternative methodologies. Examples include:
Quantitative Research; Using larger samples or longitudinal designs.
Qualitative Research; Conducting interviews or focus groups to gain deeper insights.
Mixed Methods Research; Combining surveys with interviews or observations.
Experimental Research; Investigating cause-and-effect relationships through controlled interventions.
Different methods often provide complementary perspectives on the same research problem.

5.8.8 Writing Effective Future Research Recommendations

A strong recommendation should include:

1. The aspect requiring further investigation.
2. The reason why additional research is needed.
3. A suggested research direction.

For example, Because the present study focused on university instructors, future research should examine AI adoption among school teachers and students to determine whether the proposed theoretical model remains applicable across different educational levels. This recommendation is:

- Specific.
- Logical.
- Directly connected to the current study.

Table 5.12: Weak versus Strong Future Research Statements

Weak Statement	*Strong Statement*
More research is needed.	Future studies should examine AI adoption across different countries to evaluate the cross-cultural applicability of the proposed model.
The sample should be larger.	Future research should include participants from multiple universities and educational systems to improve the generalizability of the findings.
Different methods may be useful.	Future studies could combine survey data with interviews to obtain deeper insights into instructors' experiences with AI technologies.

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5.8.9 Avoiding Common Mistakes

Researchers should avoid several common errors. Being too general. Avoid statements such as: More research is needed, explain what kind of research is needed, ignoring the findings, and future research should be based on the study's results and limitations. Also, suggesting unrealistic projects, recommendations should be achievable and scientifically meaningful, repeating the limitations section, Future research should extend beyond describing limitations by proposing constructive solutions. Introducing unrelated topics, Recommendations should remain closely connected to the research problem.

5.8.10 Future Research in the AI Adoption Study

The AI Adoption study generated several opportunities for future investigation. First, future studies could examine AI adoption among students, school teachers, and educational administrators to evaluate whether the proposed model applies across different educational groups. Second, researchers may investigate AI adoption in different countries to examine the influence of cultural and organizational factors.

Third, future research could incorporate additional constructs such as AI literacy, ethical awareness, perceived risk, or organizational readiness to improve the explanatory power of the model. Fourth, longitudinal studies could investigate how instructors' attitudes toward AI change as the technology becomes more widely integrated into higher education. Finally, mixed-method research combining surveys with interviews could provide a richer understanding of instructors' experiences and concerns regarding AI implementation. Together, these recommendations demonstrate how one completed study can generate numerous opportunities for future scientific investigation.

5.8.11 Running Case Study

At the conclusion of the AI Adoption project, the researcher proposed several future research directions. Rather than writing a single sentence stating that additional research was needed, the researcher developed specific recommendations based on the study's findings. Future investigations were encouraged to:

- Test the model in different countries.
- Compare public and private universities.
- Examine other educational stakeholders.
- Introduce new constructs such as AI ethics and organizational readiness.
- Conduct longitudinal and mixed-method studies.

These recommendations provided a clear roadmap for extending the current research and strengthening the theoretical understanding of AI adoption in higher education.

Future research recommendations demonstrate that scientific inquiry is a continuous process rather than a single completed study. Effective recommendations emerge naturally from the findings, limitations, and theoretical contributions of the current research. They identify meaningful opportunities for extending the research context, studying new populations, improving theoretical models, and applying alternative research methods. Well-developed future research directions not only strengthen the current study but also guide the next stage of scientific investigation.

5.9 Writing a Strong Conclusion

The Conclusion chapter completes the research journey by bringing together the major findings and contributions of the study.

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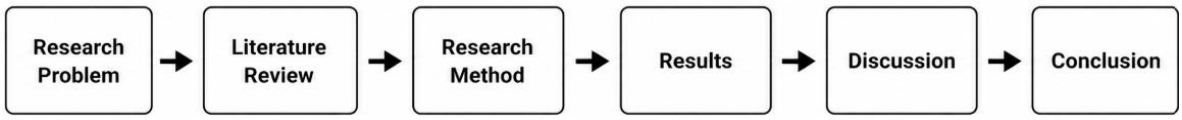

Figure 5.11: Completing the Research Journey

5.9.1 Introduction

The Conclusion is the final opportunity for researchers to communicate the value of their work. After reviewing the literature, collecting data, analyzing the results, and discussing the findings, researchers must provide a concise summary of what has been learned and why it matters. Many beginning researchers underestimate the importance of the Conclusion section. Some simply repeat paragraphs from the Results chapter, while others introduce new findings that were never discussed previously.

Neither approach is appropriate, A strong conclusion does not present new evidence. Instead, it brings together the major findings, highlights the contributions of the research, and leaves readers with a clear understanding of the significance of the study. The Conclusion should answer one final question: *"What is the overall message of this research?"*.

5.9.2 Purpose of the Conclusion

The Conclusion serves several important purposes. It should:

- Return to the research problem.
- Summarize the major findings.
- Highlight the theoretical contribution.
- Reinforce the practical implications.
- Present the overall significance of the research.
- Provide a logical ending to the study.

Unlike the Discussion chapter, which analyzes individual findings in detail, the Conclusion presents a broad overview of the entire research project.

5.9.3 Conclusion versus Discussion

Students often confuse these two sections. The *Discussion* explains the findings in detail. The *Conclusion* summarizes what those findings collectively mean. For example, A Discussion paragraph may explain why Performance Expectancy significantly influences AI Adoption. The Conclusion should simply state that the study demonstrated the importance of perceived performance benefits in encouraging AI adoption among university instructors. The Conclusion is therefore shorter, broader, and more focused on the overall contribution of the research. Although closely related, the Discussion and Conclusion serve different purposes.

Table 5.13: Discussion versus Conclusion

Discussion	*Conclusion*
Explains individual findings	Summarizes the overall study
Compares findings with previous research	Highlights the major contribution
Discusses theoretical and practical implications	Reinforces the overall significance
Examines limitations and future research	Provides a logical ending
Contains detailed interpretation	Presents a concise summary

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5.9.4 Returning to the Research Problem

A strong conclusion begins by reminding readers of the original research problem. For example, This study investigated the factors influencing the adoption of Artificial Intelligence technologies among university instructors and examined how AI adoption contributes to teaching innovation. This opening reminds readers of the purpose of the study without repeating the entire introduction. The conclusion then explains how the research successfully addressed that problem.

5.9.5 Summarizing the Major Findings

The next step is to summarize the most important findings. Researchers should avoid repeating every statistical result. Instead, they should identify the key messages. For example, The findings demonstrated that Performance Expectancy, Trust in AI, Digital Competence, and Facilitating Conditions positively influenced AI Adoption. Furthermore, AI Adoption significantly enhanced Teaching Innovation. This summary captures the essential findings without presenting detailed statistics.

5.9.6 Reinforcing the Research Contribution

After summarizing the findings, researchers should explain why the study is important. This may include: Theoretical Contribution; How the study improved scientific understanding. Practical Contribution; How the findings can improve professional practice. Methodological Contribution; How the research design or analytical approach contributes to future studies. These contributions should be summarized rather than discussed in detail. An effective conclusion combines the research problem, findings, and contributions into one coherent summary.

5.9.7 Ending the Study Effectively

The final paragraph should leave readers with a clear understanding of the value of the research. Rather than ending abruptly, researchers should emphasize the broader significance of the study. For example, As Artificial Intelligence continues to transform higher education, understanding the factors that influence its adoption becomes increasingly important. The findings of this study provide both theoretical and practical insights that may assist researchers, educators, and policymakers in supporting the responsible and effective integration of AI into teaching and learning. This ending reinforces the importance of the research while maintaining an objective academic tone.

5.9.8 Avoiding Common Mistakes

Researchers frequently make several errors when writing conclusions. Repeating the Abstract. The Conclusion should reflect the completed study rather than restating the introduction. Repeating statistical values, Detailed statistics belong in the Results section. Introducing new findings, Only findings discussed earlier should appear in the Conclusion. Writing recommendations only, Recommendations are important but should not replace the overall summary. Ending too abruptly, A strong conclusion should provide a sense of completion.

Table 5.14: Weak versus Strong Conclusions

Weak Conclusion	*Strong Conclusion*
Repeats the Results section.	Summarizes the overall contribution of the study.
Introduces new ideas.	Focuses only on findings already discussed.

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Weak Conclusion	*Strong Conclusion*
Ends with one short sentence.	Ends with a thoughtful statement about the significance of the research.
Lists recommendations only.	Integrates findings, contributions, and future importance.

5.9.9 Example Conclusion Structure

A practical conclusion may follow this sequence. Restate the research problem.

1. Summarize the major findings.
2. Highlight the theoretical contribution.
3. Highlight the practical contribution.
4. End with the overall significance of the research.

This structure is appropriate for undergraduate dissertations, master's theses, doctoral research, and journal articles.

5.9.10 Conclusion of the AI Adoption Study

The AI Adoption study concluded that university instructors are more likely to adopt Artificial Intelligence technologies when they perceive clear educational benefits, trust AI systems, possess appropriate digital competence, and receive adequate institutional support. The findings confirmed important assumptions of technology adoption theory while extending existing knowledge by demonstrating the growing importance of Trust in AI within higher education.

The study also provided practical recommendations for universities seeking to integrate AI into teaching and learning through professional development, institutional support, and responsible AI governance. Although the study was conducted within a specific educational context, it established a strong foundation for future investigations into AI adoption across different educational settings and cultural environments. Overall, the research contributes to both scientific understanding and educational practice by providing a theory-driven explanation of AI adoption in contemporary higher education.

5.9.11 Running Case Study

The final conclusion of the AI Adoption project brought together all stages of the research. Beginning with the identification of a research problem, the study developed a conceptual framework, designed and validated a measurement instrument, analyzed empirical data using SmartPLS, interpreted the findings through theory, compared them with previous literature, identified theoretical and practical contributions, acknowledged limitations, and proposed future research directions.

The conclusion emphasized that AI adoption is influenced not only by technological factors but also by trust, digital competence, and institutional support. It highlighted the importance of combining theory-driven research with practical recommendations to support effective AI integration in higher education. The research therefore concluded by demonstrating both its academic contribution and its practical value.

The Conclusion is the final opportunity to demonstrate the value of a research study. Rather than repeating statistical results or introducing new information, it summarizes the major findings, reinforces the theoretical and practical contributions, and reminds readers of the significance of the research problem. A well-written conclusion provides a clear and logical

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ending that leaves readers with a strong understanding of what the study achieved and how it contributes to scientific knowledge and professional practice.

5.10 Common Mistakes in Writing the Discussion Chapter

A strong Discussion chapter transforms research findings into scientific contribution through careful interpretation.

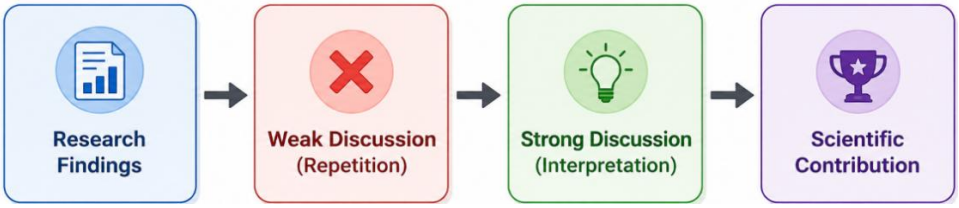

Figure 5.12: From Weak Discussion to Strong Scientific Contribution

5.10.1 Introduction

Writing the Discussion chapter is one of the most challenging tasks in academic research. Many students successfully collect data, conduct statistical analysis, and prepare professional tables. However, they often struggle to explain what their findings actually mean. As a result, Discussion chapters frequently become a repetition of the Results section rather than a scientific interpretation of the research.

This problem is not limited to undergraduate students. It is also one of the most common reasons why manuscripts submitted to international journals receive requests for major revisions or are rejected. Understanding these mistakes helps researchers produce clearer, stronger, and more convincing discussions.

5.10.2 Mistakes 1-10

Repeating the Results Section

The most common mistake is simply repeating statistical results. For example, Performance Expectancy significantly influenced AI Adoption ($\beta = 0.42$, $p < .001$). This belongs in the Results section. A Discussion chapter should explain:

- Why this relationship exists.
- How theory explains it.
- Whether previous studies reported similar findings.
- What the result contributes to knowledge.

The Discussion should focus on interpretation rather than repetition.

Ignoring the Theoretical Framework

Every theory-driven study should return to the theory that guided the research. Some students discuss findings without mentioning the theoretical framework. For example, They explain that Trust in AI is important but never relate it to UTAUT or technology acceptance theory. Without theory, research findings become isolated observations rather than scientific contributions. Always ask: *"What does this finding tell us about the theory?"*.

Ignoring Previous Literature

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Some discussions explain findings without comparing them with previous research. Scientific knowledge develops by comparing evidence across studies. Researchers should discuss:

- Agreements.
- Partial agreements.
- Contradictory findings.

Comparisons help readers understand whether the current study confirms, extends, or refines existing knowledge.

Overstating the Findings

Researchers sometimes make claims that extend beyond the evidence collected.

Examples include:

- "This study proves the theory."
- "The findings apply to every university."
- "AI will completely transform education."

Scientific writing should remain balanced. More appropriate expressions include:

- "The findings support..."
- "The results suggest..."
- "The evidence indicates..."

Balanced language strengthens credibility.

Ignoring Unsupported Hypotheses

Some researchers discuss only statistically significant findings. This is a missed opportunity. Unsupported hypotheses may:

- Reveal contextual influences.
- Identify limitations of existing theories.
- Suggest new research questions.
- Improve scientific understanding.

Every hypothesis deserves thoughtful discussion.

Weak Practical Implications

Recommendations should emerge directly from the findings. For example, Suppose Performance Expectancy strongly predicts AI Adoption. A weak recommendation would be: Universities should improve education. A stronger recommendation would be: Universities should organize practical workshops demonstrating how AI technologies improve teaching effectiveness because perceived educational benefits were the strongest predictor of AI Adoption. Specific recommendations are more useful than general statements. Effective recommendations are evidence-based and directly related to the research findings.

Table 5.15: Weak versus Strong Recommendations

Weak Recommendation	*Strong Recommendation*
Universities should use AI.	Universities should demonstrate practical classroom applications of AI through structured professional development programs.
Teachers need more training.	Institutions should provide continuous AI-focused training that develops both digital competence and confidence in AI technologies.

Weak Discussion of Limitations

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Some students avoid discussing limitations because they believe this weakens the study. Others list numerous weaknesses without explanation. Neither approach is appropriate. Researchers should:

- Acknowledge limitations honestly.
- Explain their influence.
- Suggest how future research can address them.

This demonstrates scientific maturity.

Writing General Future Research Statements

One of the most frequently written sentences in student dissertations is: More research is needed. Although true, this statement provides little value. A stronger recommendation specifies:

- What should be investigated.
- Why it is important.
- How it extends the current study.

Future research recommendations should provide a clear direction for subsequent investigations.

Poor Organization

A well-written Discussion follows a logical structure. Researchers should avoid moving randomly between:

- Theory.
- Literature.
- Findings.
- Recommendations.
- Limitations.

A recommended sequence is:

1. Interpret findings.
2. Compare with previous studies.
3. Discuss theoretical contributions.
4. Explain practical implications.
5. Identify limitations.
6. Suggest future research.
7. Conclude the discussion.

Logical organization improves readability and strengthens the overall argument.

Forgetting the Research Questions

Table 5.16: Common Discussion Mistakes and Recommended Solutions

Common Mistake	*Recommended Solution*
Repeating statistical results	Explain the meaning of the findings.
Ignoring theory	Return to the theoretical framework.
Ignoring previous studies	Compare findings with relevant literature.
Overstating conclusions	Use balanced academic language.
Ignoring unsupported hypotheses	Discuss them objectively.
Weak practical implications	Base recommendations on empirical evidence.
Poor discussion of limitations	Explain research boundaries honestly.

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Common Mistake	*Recommended Solution*
General future research statements	Provide specific recommendations.
Poor organization	Follow a logical discussion structure.
Forgetting research questions	Return to the original objectives.

The Discussion chapter should answer the questions introduced at the beginning of the study. Sometimes researchers become so focused on statistical analysis that they forget the original research objectives. An effective discussion repeatedly returns to:

- The research problem.
- The research questions.
- The research objectives.

This creates consistency throughout the research project. Avoiding these common mistakes greatly improves the quality of the Discussion chapter.

5.10.3 The Discussion Checklist

Before submitting a dissertation or journal article, researchers should ask:

✓ Have I explained rather than repeated my findings?

✓ Have I interpreted the results using theory?

✓ Have I compared my findings with previous studies?

✓ Have I discussed supported and unsupported hypotheses?

✓ Have I identified theoretical contributions?

✓ Have I explained practical implications?

✓ Have I acknowledged limitations?

✓ Have I proposed meaningful future research?

✓ Does the discussion answer the research questions?

✓ Does the conclusion summarize the overall contribution?

If the answer to all these questions is *Yes*, the Discussion chapter is likely to be clear, balanced, and scientifically convincing.

5.10.4 Running Case Study

The researcher reviewed the AI Adoption study before final submission. Using the Discussion Checklist, several improvements were made. Statistical results were shortened, while theory-based interpretation was expanded. Additional comparisons with previous AI adoption studies were included. The practical implications were rewritten to provide specific recommendations for universities, and future research directions were linked directly to the study's limitations. The final Discussion chapter became more coherent, more persuasive, and more suitable for publication in an international journal.

A strong Discussion chapter is distinguished not by the number of statistical results it contains but by the quality of its interpretation. Researchers should avoid repeating results, ignoring theory, overlooking previous literature, overstating conclusions, or providing vague recommendations. Instead, they should develop a logical, theory-driven discussion that explains the meaning of the findings, demonstrates their contribution to scientific knowledge, and provides realistic recommendations for practice and future research. A well-written Discussion chapter transforms statistical evidence into meaningful scientific contribution and represents one of the strongest indicators of high-quality academic research.

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5.11 Chapter Summary

Chapter 5 demonstrated how empirical findings are transformed into meaningful scientific knowledge through critical interpretation and discussion. While previous chapters focused on developing the research model, collecting data, and conducting SmartPLS analysis, this chapter emphasized that statistical results alone do not constitute a scientific contribution.

The chapter explained the purpose of the Discussion chapter and highlighted the importance of interpreting findings through theory rather than simply repeating statistical results. Readers learned how to compare their findings with previous studies, explain supported and unsupported hypotheses, and identify the theoretical contribution of their research by confirming, extending, refining, or integrating existing knowledge.

The chapter also emphasized the importance of developing practical implications that translate research findings into actionable recommendations for practitioners and decision-makers. In addition, readers learned how to discuss research limitations objectively and use them as a foundation for proposing meaningful directions for future research. The chapter concluded by explaining how to write a concise and effective conclusion that summarizes the study's major contributions without introducing new information.

Throughout the chapter, the running case study on *Artificial Intelligence Adoption in Higher Education* illustrated how SmartPLS results can be interpreted to produce theoretical insights, practical recommendations, and scientific contributions. By the end of the chapter, readers had learned that meaningful research extends beyond statistical analysis; it is achieved through thoughtful interpretation, critical discussion, and the clear communication of findings that advance both theory and practice.

5.12 Running Case Study: Completing the AI Adoption Research Project

Writing the Discussion and Conclusion

Purpose of the Case Study; In the previous chapters, the AI Adoption in Higher Education project progressed from identifying the research problem to developing the theoretical model, designing the measurement instrument, and analyzing the data using SmartPLS. In this chapter, the researcher completes the study by interpreting the findings, identifying the theoretical and practical contributions, discussing the limitations, proposing future research, and writing the conclusion.

Step 1: Interpreting the Findings: The SmartPLS results indicate that Performance Expectancy, Effort Expectancy, Facilitating Conditions, Trust in AI, Digital Competence, and AI Adoption → Teaching Innovation are supported, whereas Social Influence → AI Adoption is not supported. The researcher explains these findings using the theoretical framework rather than simply reporting the statistical results.

Step 2: Comparing with Previous Studies: The findings are compared with previous literature. While the significant effects of the UTAUT constructs are consistent with earlier studies, the importance of Trust in AI extends existing knowledge. The non-significant effect of Social Influence suggests a possible context-specific explanation that warrants further investigation.

Step 3: Identifying the Contribution: The study confirms key UTAUT relationships, extends the model by incorporating Trust in AI and Digital Competence, and demonstrates the role of AI Adoption in promoting Teaching Innovation among university instructors.

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Step 4: Practical Implications: The findings suggest that universities should strengthen AI training, improve digital infrastructure, enhance instructors' digital competence, and establish clear policies for the responsible use of AI in teaching.

Step 5: Limitations, Future Research, and Conclusion: The researcher acknowledges limitations related to context, cross-sectional design, and self-reported data, and recommends future studies involving different educational settings, populations, and additional AI-related constructs. The chapter concludes by summarizing the study's key findings and emphasizing its theoretical and practical contributions.

What Has Been Achieved?

By the end of Chapter 5, the researcher has:

✓ Interpreted the research findings through theory.

✓ Compared the findings with previous studies.

✓ Identified theoretical and practical contributions.

✓ Acknowledged research limitations.

✓ Proposed future research directions.

✓ Written a clear and meaningful conclusion.

The research project is now complete and ready to be communicated to the wider scientific community.

5.13 **Analytical Review & Critical Inquiry**

Before moving forward, pause to evaluate the core assumptions and structural relationships introduced in this chapter

📖 Why is repeating statistical results considered a weakness in the Discussion chapter?

📖 Can unsupported hypotheses contribute to scientific knowledge? Explain your answer with an example.

📖 Why should researchers compare their findings with previous studies instead of discussing them independently?

📖 Explain how research limitations can become opportunities for future research.

📖 Why is balanced academic language important when discussing research findings?

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Chapter 6

Writing and Publishing Scientific Research

Chapter purpose: This chapter explains how to transform a completed research project into a publishable scientific manuscript. Readers will learn how to organize and write each section of a journal article, select an appropriate target journal, prepare a manuscript that meets publication standards, respond effectively to reviewers' comments, and apply the principles of research ethics and publication integrity. By the end of the chapter, readers will be able to communicate their research clearly and professionally, increasing the likelihood of successful publication in international journals.

Chapter Learning Objectives

After completing this chapter, readers should be able to:

1. Organize a completed research project into the structure of a scientific journal article.
2. Write clear and effective manuscript sections, including the title, abstract, introduction, methods, results, discussion, and conclusion.
3. Select an appropriate journal and prepare a manuscript that meets its submission requirements.
4. Apply the principles of research ethics and publication integrity throughout the publication process.
5. Respond professionally to reviewers' comments and revise a manuscript for publication.
6. Apply the concepts presented in this chapter to prepare the accompanying running case study for submission to an international journal.

Introduction

Conducting a research project is a significant achievement, but scientific research is not complete until its findings are communicated to the wider academic community. After identifying a research problem, developing a theory-driven research model, designing a valid measurement instrument, analyzing data using SmartPLS, and interpreting the findings, researchers must transform their work into a publishable scientific manuscript. Publication enables research to be evaluated, applied, and extended by other researchers, thereby contributing to the advancement of scientific knowledge.

Publishing a journal article requires more than simply shortening a thesis or dissertation. It involves organizing research according to international publication standards, writing clearly and concisely, selecting an appropriate journal, and understanding the editorial and peer-review

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process. In addition, researchers must follow the principles of academic integrity and ethical publishing to ensure the credibility of their work.

This chapter presents the final stage of the research lifecycle by explaining how to prepare a research manuscript for publication. Readers will learn how to write each section of a journal article, select a suitable journal, navigate the submission and peer-review process, respond to reviewer comments, and apply ethical publishing practices. The running case study on *Artificial Intelligence Adoption in Higher Education* continues throughout the chapter, illustrating how a completed research project is transformed into a publishable journal article.

The central message of this chapter is that conducting high-quality research is only part of the research journey. Equally important is the ability to communicate research effectively so that it can inform future studies, influence practice, and contribute to scientific progress.

6.1 Understanding Scientific Publications

Scientific publication is the final stage of the research process, allowing new knowledge to be shared, evaluated, and expanded by the scientific community.

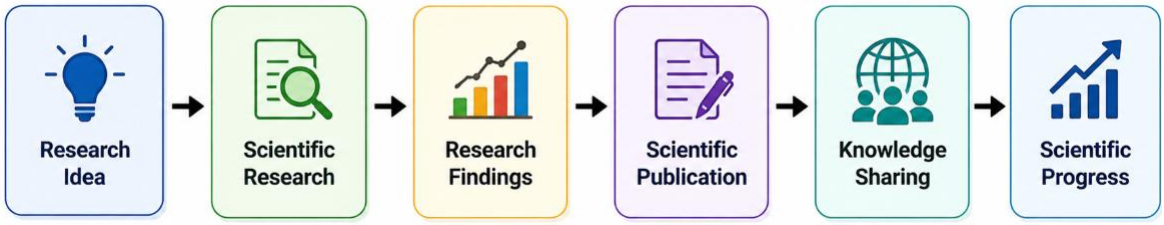

Figure 6.1: The Scientific Publication Ecosystem

6.1.1 Introduction

Scientific research achieves its greatest value when its findings are shared with others. A research project may involve months or even years of planning, data collection, analysis, and interpretation. However, if the findings remain only in a thesis, dissertation, or personal computer, their impact is limited. Publication enables researchers to communicate their discoveries, receive feedback, contribute to scientific knowledge, and inspire future research.

Scientific publishing is therefore considered an essential part of the research process rather than an optional activity. Publishing allows researchers to demonstrate that their work has undergone scientific evaluation and contributes to the advancement of knowledge within a particular discipline.

6.1.2 What Is a Scientific Publication?

A **scientific publication** is a written document that presents original research, reviews existing knowledge, or introduces new scientific ideas following recognized academic standards. Scientific publications are normally reviewed by experts before publication to ensure their quality, originality, and scientific validity. Most publications include:

- A clear research problem.
- A review of relevant literature.
- An appropriate research methodology.
- Results supported by evidence.
- Discussion and interpretation.
- References to previous research.

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Unlike reports written for internal organizations, scientific publications are intended for a wider academic audience and become part of the permanent scientific record. Scientific publications communicate original knowledge that has been evaluated according to academic standards.

6.1.3 Why Do Researchers Publish?

Researchers publish for many reasons. The most important reason is to contribute new knowledge that advances science and improves professional practice. Publishing also allows researchers to:

- Share discoveries with the scientific community.
- Validate research through peer review.
- Receive constructive feedback.
- Support evidence-based decision-making.
- Build academic reputation.
- Meet graduation or promotion requirements.
- Encourage collaboration with other researchers.
- Increase the visibility and impact of their work.

For universities, publication contributes to institutional reputation and international recognition. For society, publication provides reliable evidence that can influence education, healthcare, technology, business, and public policy.

Table 6.1: Benefits of Scientific Publishing

Stakeholder	*Benefit*
Researchers	Share knowledge, gain recognition, and develop academic careers
Universities	Improve research reputation and institutional ranking
Students	Learn from current scientific discoveries
Organizations	Apply research findings to improve practice
Society	Benefit from evidence-based policies and innovation

Scientific publishing benefits researchers, institutions, and society by promoting the dissemination and application of knowledge.

6.1.4 Types of Scientific Publications

Scientific information is communicated through several publication formats. Each serves a different purpose. Journal Articles; Journal articles are the most common form of scientific publication. They present original research, review articles, or methodological developments and are usually subjected to peer review before publication. Journal articles are often considered the primary measure of academic research productivity.

Conference Papers; Conference papers present research findings at academic conferences. They allow researchers to receive early feedback, discuss ideas with colleagues, and introduce emerging research before full journal publication. Some conference papers are later expanded into journal articles.

Review Articles; Review articles summarize and critically evaluate existing research on a particular topic. Rather than presenting new empirical data, they identify research trends, gaps, and future directions. Systematic reviews and meta-analyses are examples of review articles.

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Books and Book Chapters; Academic books provide comprehensive coverage of a subject. Book chapters often focus on specific topics within edited volumes written by multiple authors.

Theses and Dissertations; Theses and dissertations document original academic research completed for undergraduate, master's, or doctoral degrees. Many high-quality theses are later converted into journal articles.

Scientific knowledge is communicated through several publication formats, each serving different academic purposes.

6.1.5 Journal Articles versus Conference Papers

Beginning researchers often ask whether they should publish a conference paper or a journal article. Although both contribute to scientific communication, important differences exist. Journal articles generally:

- Contain more comprehensive analysis.
- Undergo a longer review process.
- Have higher academic recognition.
- Require greater methodological detail.

Conference papers generally:

- Present preliminary or emerging research.
- Allow rapid dissemination of new ideas.
- Encourage discussion with other researchers.
- May later be developed into journal articles.

Neither format is universally better. The choice depends on the research objectives and stage of the project.

Table 6.2: Journal Articles versus Conference Papers

Journal Article	*Conference Paper*
More detailed	Usually shorter
Comprehensive analysis	Early presentation of research
Longer review process	Faster publication
Higher academic recognition	Greater opportunity for discussion
Often used for promotion	Often used to obtain feedback

Journal articles and conference papers complement one another within the scientific publication process.

6.1.6 Open Access and Subscription Journals

Researchers should understand the two major publishing models. Open access journals allow readers to access published articles free of charge. Some open access journals require authors to pay an Article Processing Charge (APC), while others are supported by universities or research organizations and do not charge publication fees. Advantages include:

- Greater visibility.
- Wider readership.
- Increased accessibility.

Subscription journals require readers or institutions to pay for access. Many universities provide access through library subscriptions. Although readers pay for access, authors often publish without paying publication fees. Both publishing models include many high-quality journals.

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Researchers should evaluate journal quality rather than choosing solely on the basis of access model.

6.1.7 The Role of Peer Review

One feature distinguishes scientific publications from many other forms of writing. Most reputable journals use *peer review*. Peer review means that independent experts evaluate a manuscript before publication. Reviewers examine:

- Originality.
- Research design.
- Data analysis.
- Interpretation.
- Writing quality.
- Ethical standards.

Their recommendations help editors decide whether the manuscript should be accepted, revised, or rejected. Peer review improves both the quality and credibility of scientific research. A detailed explanation of the peer-review process will be presented later in this chapter.

6.1.8 The Impact of Scientific Publications

Scientific publications influence many aspects of society. Research findings published in reputable journals may:

- Improve educational practices.
- Support healthcare decisions.
- Guide public policy.
- Encourage technological innovation.
- Solve industrial problems.
- Stimulate future scientific investigations.

Every published study becomes part of the growing body of scientific knowledge upon which future discoveries are built. Publication is therefore not the end of research but the beginning of its influence.

6.1.9 Running Case Study

After completing the AI Adoption study, the researcher considered how to communicate the findings. Several publication options were available. The researcher could:

- Submit a conference paper to receive early feedback.
- Prepare a journal article for publication in an international education or information systems journal.
- Include the study as part of a doctoral dissertation.
- Develop a book chapter discussing AI adoption in higher education.

After reviewing the objectives of the research, the researcher decided to prepare a journal article because it offered the greatest opportunity to communicate the findings to the international research community and contribute to technology adoption literature.

Scientific publications are the primary means through which researchers communicate new knowledge to the academic community and society. Whether published as journal articles, conference papers, review articles, books, or theses, scientific publications ensure that research findings become part of the permanent scientific record. By sharing their work through reputable publication channels, researchers contribute to the advancement of science, support evidence-based practice, and provide a foundation for future discoveries. Publication is therefore the final and essential stage of the research lifecycle.

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6.2 Structure of a Scientific Research Paper (IMRAD)

Most scientific journals organize research papers using a logical structure that guides readers from the research problem to the final conclusions.

Figure 6.2: The IMRAD Structure

6.2.1 Introduction

Scientific research should communicate ideas in a clear, logical, and organized manner. Readers expect research papers to follow a familiar structure that allows them to locate information quickly and understand how the study was conducted. For this reason, most scientific journals follow the **IMRAD** format. IMRAD stands for:

- **I** – Introduction
- **M** – Methods
- **R** – Results
- **A** – And
- **D** – Discussion

Although journals may use different section titles or include additional sections, the underlying structure remains largely the same. The IMRAD format presents research as a logical sequence, beginning with the research problem and ending with the interpretation of the findings.

6.2.2 Why Is IMRAD Important?

The IMRAD structure has become the international standard for reporting scientific research because it improves clarity, consistency, and readability. Using a common structure helps readers answer important questions.

- What problem was investigated?
- Why was the study conducted?
- How was the research performed?
- What were the findings?
- What do the findings mean?

Following a standardized structure also makes it easier for editors and reviewers to evaluate manuscripts during the publication process. Each section of the IMRAD structure answers a specific question about the research.

Figure 6.3: Questions Answered by IMRAD

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6.2.3 Title

The title is the first part of the paper that readers see. A good title should:

- Clearly describe the research topic.
- Reflect the main variables or concepts.
- Be concise and informative.
- Avoid unnecessary abbreviations.
- Attract the attention of the intended audience.

For example, *Artificial Intelligence Adoption in Higher Education: A SmartPLS Analysis of University Instructors.* This title immediately informs readers about the topic, context, and analytical approach.

6.2.4 Abstract

The abstract provides a concise summary of the entire study. It usually includes:

- Research background.
- Research objective.
- Methodology.
- Major findings.
- Main conclusion.

Many readers decide whether to continue reading the paper based on the abstract. Therefore, it should accurately represent the entire study.

6.2.5 Keywords

Keywords help search engines, indexing databases, and researchers locate published articles. Good keywords should:

- Represent the main concepts.
- Match commonly used terminology.
- Avoid unnecessary repetition.

For the AI Adoption study, suitable keywords include:

- Artificial Intelligence
- Technology Adoption
- Higher Education
- SmartPLS
- UTAUT

6.2.6 Introduction

The Introduction explains why the research was conducted. It should:

- Introduce the topic.
- Explain the research problem.
- Present the research gap.
- State the research objectives.
- Introduce the theoretical framework.
- Explain the significance of the study.

A strong Introduction encourages readers to continue reading the paper.

6.2.7 Literature Review

The Literature Review summarizes existing knowledge related to the research topic. Its purpose is to:

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- Review previous studies.
- Identify research gaps.
- Explain the theoretical framework.
- Support hypothesis development.

Rather than listing previous studies, researchers should critically evaluate existing knowledge and demonstrate how the current study contributes to the field.

6.2.8 Methodology

The Methodology explains exactly how the research was conducted. Typical components include:

- Research design.
- Participants.
- Sampling method.
- Data collection.
- Measurement instrument.
- Data analysis procedures.
- Ethical considerations.

The methodology should contain enough detail for another researcher to replicate the study. The Methodology section describes every major step of the research process.

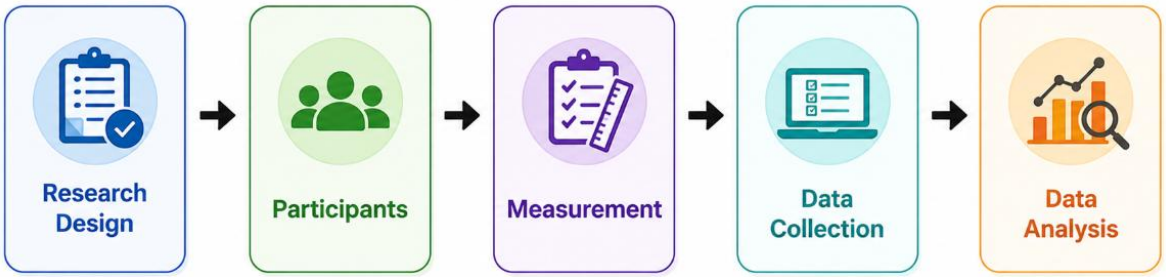

Figure 6.4: Components of the Methodology

6.2.9 Results

The Results section presents the findings objectively. It includes:

- Descriptive statistics.
- Reliability analysis.
- Validity analysis.
- Hypothesis testing.
- SmartPLS output.
- Tables and figures.

Researchers should avoid extensive interpretation in this section. The Results answer one question: *What did the analysis show?*

6.2.10 Discussion

The Discussion explains the meaning of the findings. This section should:

- Interpret the results.
- Return to the theoretical framework.
- Compare findings with previous studies.
- Explain theoretical contributions.
- Discuss practical implications.

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- Identify limitations.
- Recommend future research.

The Discussion answers: **Why do these findings matter?**

6.2.11 Conclusion

The Conclusion summarizes the entire study. It should:

- Return to the research problem.
- Summarize the major findings.
- Highlight contributions.
- Reinforce the significance of the research.

The Conclusion should not introduce new findings or detailed statistical analysis.

6.2.12 References

Every scientific paper concludes with a list of references. References:

- Acknowledge previous research.
- Demonstrate academic integrity.
- Allow readers to locate original sources.

Researchers should follow the citation style required by the target journal, such as APA 7, IEEE, or Vancouver.

6.2.13 Appendices

Table 6.3: Purpose of Each Section of a Scientific Paper

Section	*Purpose*
Title	Introduces the topic
Abstract	Summarizes the entire study
Keywords	Improve discoverability
Introduction	Presents the research problem and objectives
Literature Review	Reviews previous research and theory
Methodology	Explains how the research was conducted
Results	Presents the findings objectively
Discussion	Interprets and explains the findings
Conclusion	Summarizes the overall contribution
References	Credit previous work and support academic integrity
Appendices	Provide supporting information when necessary

Some journals allow appendices. Typical appendices include:

- Survey questionnaire.
- Interview protocol.
- Additional statistical tables.
- Ethical approval documents.
- Supplementary materials.

Appendices should include only information that supports the paper but is too detailed for the main text. Every section of a scientific paper has a specific purpose that contributes to the overall quality of the manuscript.

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6.2.14 Logical Flow of a Scientific Paper

A well-written scientific paper follows a logical progression.
The Introduction identifies the problem. The Literature Review explains existing knowledge.
The Methodology describes how the study was conducted.
The Results present the evidence.
The Discussion explains the meaning of that evidence.
The Conclusion summarizes the overall contribution.
This logical sequence helps readers understand not only **what** was done but also **why** it was done and **why it matters**.

6.1.15 Running Case Study

The researcher transformed the completed AI Adoption thesis into a journal article. Rather than submitting the entire thesis, the researcher reorganized the content according to the IMRAD structure. The manuscript included:

- A concise and informative title.
- A structured abstract.
- Five keywords.
- A focused introduction emphasizing the research gap.
- A literature review based on UTAUT and AI adoption studies.
- A methodology describing the survey and SmartPLS analysis.
- A results section presenting the statistical findings.
- A discussion interpreting the findings through theory.
- A concise conclusion highlighting the study's contributions.
- References formatted according to APA 7.

By following the IMRAD structure, the researcher produced a manuscript that met the expectations of international scientific journals. The IMRAD structure provides a clear and internationally recognized framework for organizing scientific research papers. By following a logical sequence—from the research problem to the methodology, results, discussion, and conclusion—researchers communicate their work in a way that is easy for readers, reviewers, and editors to understand. A well-structured manuscript not only improves readability but also increases the likelihood of successful publication in reputable scientific journals.

6.3 Writing Each Section of a Journal Article

Every section of a journal article contributes to communicating the research clearly and logically.

6.3.1 Introduction

A journal article is much shorter than a thesis or dissertation, but it must still present a complete research study. Unlike a thesis, which may contain several chapters, a journal article usually combines the most important information into one concise manuscript. Every section must therefore be carefully written so that readers can quickly understand the purpose, methods, findings, and contribution of the research. Although each journal has its own formatting requirements, the overall writing principles remain similar. The following sections explain how to prepare each part of a scientific journal article.

6.3.2 Writing an Effective Title

The title is the first part of the manuscript that readers notice. A good title should:

- Clearly describe the research topic.
- Reflect the main variables or concepts.
- Be concise and informative.
- Avoid unnecessary abbreviations.
- Attract the attention of the intended audience.

Weak Title; A Study of AI. Better Title; Artificial Intelligence Adoption in Higher Education: A SmartPLS Analysis of University Instructors. The second title clearly explains the topic, context, and research method.

6.3.3 Writing the Abstract

The abstract summarizes the entire study in a single paragraph. Many journals require an abstract of *150–250 words*. A good abstract briefly explains:

- The research problem.
- The objective of the study.
- The methodology.
- The major findings.
- The main conclusion.

Readers often decide whether to continue reading the article based on the abstract. For this reason, it should be accurate, concise, and informative. An effective abstract provides a complete overview of the study in a logical sequence.

Background → Objective → Method → Results → Conclusion

6.3.4 Selecting Keywords

Keywords improve the visibility of research in online databases. Researchers should select keywords that:

- Represent the main concepts.
- Reflect common terminology used in the field.
- Support electronic searching and indexing.

For example, A study on AI adoption may use:

- Artificial Intelligence
- Higher Education
- Technology Adoption
- UTAUT
- SmartPLS

Most journals request between *three and six keywords*.

6.3.5 Writing the Introduction

The Introduction explains why the research was conducted. A strong introduction normally includes:

- Background information.
- The research problem.
- The research gap.
- Research objectives.
- The significance of the study.
- A brief introduction to the theoretical framework.

The Introduction should encourage readers to continue reading by demonstrating that the research addresses an important problem.

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6.3.6 Writing the Literature Review

The Literature Review explains what is already known about the research topic. Rather than listing previous studies, researchers should:

- Organize the literature logically.
- Compare previous findings.
- Identify research gaps.
- Explain the theoretical foundation.
- Justify the proposed hypotheses.

A strong literature review demonstrates how the current study contributes to existing knowledge.

6.3.7 Writing the Methodology

The Methodology should explain exactly how the research was conducted. Typical components include:

- Research design.
- Study population.
- Sampling method.
- Data collection procedures.
- Measurement instrument.
- Data analysis techniques.
- Ethical considerations.

The description should be detailed enough for another researcher to repeat the study.

Table 6.4: Typical Components of a Methodology Section

Component	*Purpose*
Research Design	Explains the overall approach
Population and Sample	Describes the participants
Data Collection	Explains how data were obtained
Measurement Instrument	Describes questionnaire or other tools
Data Analysis	Explains statistical techniques used
Ethics	Describes ethical approval and participant protection

6.3.8 Writing the Results

The Results section presents the research findings objectively. Researchers should:

- Present tables and figures clearly.
- Report statistical results accurately.
- Follow the order of the hypotheses.
- Avoid interpreting the findings.

For example, Instead of explaining why a relationship exists, simply report whether it was statistically significant. Interpretation belongs in the Discussion section.

6.3.9 Writing the Discussion

The Discussion explains the meaning of the findings. Researchers should:

- Interpret the results.
- Return to the theoretical framework.

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- Compare findings with previous studies.
- Discuss supported and unsupported hypotheses.
- Explain theoretical contributions.
- Present practical implications.

The Discussion answers one important question: *Why do these findings matter?*

6.3.10 Writing the Conclusion

The Conclusion provides a concise summary of the study. It should:

- Return to the research objectives.
- Summarize the major findings.
- Highlight the main contributions.
- Reinforce the significance of the research.

The Conclusion should not introduce new results or detailed statistical information.

6.3.11 Writing the References

References acknowledge the work of other researchers and demonstrate academic integrity. Researchers should:

- Follow the required citation style.
- Ensure every in-text citation appears in the reference list.
- Verify the accuracy of publication details.
- Include recent and relevant sources whenever possible.

Reference management software can help maintain consistency throughout the manuscript.

6.3.12 Maintaining Consistency

Every section of a journal article should be connected. For example:

- The research objectives introduced in the Introduction should be addressed in the Results and Discussion.
- The hypotheses developed from the Literature Review should be tested in the Results.
- The conclusions should reflect the findings presented in the Discussion.

Consistency improves both readability and scientific quality. Every section of a journal article should contribute to answering the original research problem.

Research Problem → Objectives → Methodology → Results → Discussion → Conclusion

6.3.13 Common Writing Tips

Researchers should remember several simple writing principles.

- Write clearly and directly.
- Use short, meaningful sentences.
- Avoid unnecessary repetition.
- Use appropriate academic language.
- Support statements with evidence.
- Follow the journal's author guidelines.
- Revise the manuscript several times before submission.

Good writing improves both readability and the likelihood of publication.

6.3.14 Running Case Study

The researcher converted the completed AI Adoption thesis into a journal article. Several changes were necessary. The original thesis title was shortened to make it more suitable for a

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journal article. The abstract was rewritten in approximately 200 words to summarize the purpose, methodology, findings, and contribution of the study.

The Introduction was condensed to emphasize the research gap and objectives, while the Literature Review focused only on the most relevant studies and the UTAUT framework.

The Methodology summarized the survey design, participant characteristics, questionnaire development, and SmartPLS analysis. The Results highlighted only the most important statistical findings, and the Discussion emphasized theoretical contributions and practical implications.

Finally, the Conclusion summarized the study's significance in a concise manner suitable for journal publication. The completed manuscript was substantially shorter than the original thesis but retained the essential scientific contribution.

Writing a scientific journal article requires more than presenting research findings. Each section of the manuscript has a specific purpose and contributes to communicating the research clearly, logically, and professionally. Effective titles attract readers, abstracts summarize the study, introductions establish the research problem, methodologies explain the research process, results present the evidence, discussions interpret the findings, and conclusions reinforce the overall contribution. When these sections are well connected and written in a clear academic style, the manuscript becomes much more suitable for publication in reputable scientific journals.

6.4 Choosing the Right Journal

Selecting an appropriate journal is an important step before submitting a manuscript.

Figure 6.5: Steps in Selecting a Journal

6.4.1 Introduction

One of the most common reasons for manuscript rejection is submission to an unsuitable journal. A research paper may be scientifically sound, well written, and methodologically rigorous, yet still be rejected because it does not match the journal's scope, audience, or publication priorities. Choosing the right journal should therefore begin before submission.

Researchers should evaluate whether the journal regularly publishes studies related to their topic, methodology, and academic discipline. Selecting an appropriate journal increases the likelihood that the manuscript will receive a fair review and reach the intended audience.

6.4.2 Why Journal Selection Matters

Every scientific journal has a specific purpose. Some journals publish research in education, while others specialize in healthcare, engineering, information technology, management, or the social sciences.

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Similarly, some journals emphasize theoretical research, whereas others focus on applied studies. Submitting a manuscript outside the journal's scope often leads to immediate rejection before peer review. Therefore, researchers should carefully match the manuscript with the journal's aims and objectives.

6.4.3 Factors to Consider When Selecting a Journal

Several factors should be evaluated before choosing a journal. Scope; Does the journal publish research related to your topic?. For example, a study on AI adoption in higher education should be submitted to journals focusing on educational technology, information systems, or higher education.

Target Audience; Who will read the journal?. Researchers should consider whether the journal reaches academics, practitioners, policymakers, or a combination of these groups.

Quality; Researchers should evaluate the reputation of the journal using recognized quality indicators. These indicators are discussed later in this section.

Publication Speed; Some journals complete peer review within a few months, while others may require a year or longer. Researchers with graduation or promotion deadlines should consider the average review time.

Acceptance Rate; Highly prestigious journals often have lower acceptance rates. Beginning researchers may choose journals with realistic acceptance levels while maintaining appropriate quality standards.

Publication Fees; Some journals charge publication or article processing fees, while others publish accepted manuscripts free of charge. Researchers should verify publication costs before submission.

Table 6.5: Factors to Consider When Choosing a Journal

Factor	*Questions to Ask*
Scope	Does the journal publish research on my topic?
Audience	Who will read my article?
Quality	Is the journal well recognized?
Review Time	How long does peer review usually take?
Publication Fees	Are publication charges required?
Acceptance Rate	Is the journal appropriate for my level of research?

6.4.4 Understanding Journal Quality Indicators

Researchers frequently encounter terms such as *Impact Factor, CiteScore, Q1, or Scopus-indexed.* These indicators help evaluate journal visibility and influence.

Impact Factor; The Impact Factor measures the average number of citations received by articles published in a journal over a specific period. Generally, journals with higher Impact Factors receive greater academic recognition.

CiteScore; CiteScore is another citation-based indicator that measures the average number of citations received by articles published in a journal. It is commonly used for journals indexed in the Scopus database.

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Quartiles (Q1–Q4); Many journals are grouped into four quartiles based on their performance within a subject area.

- **Q1** – Top 25% of journals.
- **Q2** – Next 25%.
- **Q3** – Third 25%.
- **Q4** – Final 25%.

Higher quartiles generally indicate stronger journal influence, although good research can be published in journals across all quartiles.

6.4.5 Major Indexing Databases

Many universities and research organizations recognize publications indexed in reputable databases. The most widely used databases include:

Scopus; One of the world's largest abstract and citation databases covering a wide range of disciplines.

Web of Science; A major citation database known for indexing high-quality journals across many academic fields.

PubMed; A specialized database focusing primarily on medicine and health sciences.

IEEE Xplore; A leading digital library for engineering, computer science, and information technology research.

ACM Digital Library; An important source of publications in computer science and information systems.

Researchers should verify that a journal is indexed in the databases recognized by their institution or funding agency.

6.4.6 Recognizing Predatory Journals

Not all journals maintain appropriate academic standards. Predatory journals often charge publication fees while providing little or no genuine peer review. Warning signs include:

- Unrealistically rapid acceptance.
- Poor-quality websites.
- Unclear editorial boards.
- Frequent spelling or grammatical errors.
- False claims regarding indexing.
- Aggressive email invitations.
- Lack of transparent peer-review procedures.

Researchers should carefully evaluate journals before submission.

Table 6.6: Reputable versus Predatory Journals

Reputable Journal	*Predatory Journal*
Genuine peer review	Little or no peer review
Transparent editorial board	Unclear or fake editorial information
Accurate indexing information	False indexing claims
Clear publication policies	Limited transparency
Recognized by universities	Often not recognized academically

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6.4.7 Reading the Author Guidelines

Before submission, researchers should carefully read the journal's author guidelines. These guidelines explain:

- Manuscript formatting.
- Word limits.
- Reference style.
- Figure and table requirements.
- Ethical declarations.
- Submission procedures.

Ignoring author guidelines may result in immediate rejection or requests for technical revisions.

6.4.8 Matching Your Manuscript to the Journal

Researchers should ask several questions before submitting.

- Does my research fit the journal's scope?
- Does the journal publish similar studies?
- Does my methodology match the journal's expectations?
- Is the manuscript written according to the journal's style?
- Does the journal reach my intended audience?

Answering these questions helps improve the chances of successful publication.

6.4.9 Avoiding Common Mistakes

Beginning researchers frequently make several mistakes. These include:

- Selecting journals without reading their scope.
- Choosing journals based only on publication speed.
- Ignoring publication fees.
- Failing to follow author guidelines.
- Submitting to predatory journals.
- Assuming higher Impact Factor always means a better choice.

The best journal is not necessarily the highest-ranked journal. It is the journal that best matches the quality, scope, and audience of the research.

6.4.10 Running Case Study

The researcher completed the AI Adoption study and identified several possible journals. Each journal was evaluated using the following criteria:

- Scope related to educational technology and information systems.
- Indexing in Scopus.
- Q1 or Q2 ranking.
- Publication of SmartPLS-based quantitative research.
- Reasonable review time.
- Clear author guidelines.

After comparing several journals, the researcher selected one that regularly published research on technology adoption in higher education and followed APA style. Because the manuscript matched the journal's aims and scope, it proceeded successfully to peer review.

Selecting the appropriate journal is one of the most important decisions in the publication process. Researchers should evaluate the journal's scope, target audience, quality indicators, indexing status, publication policies, and author guidelines before submitting a manuscript. A well-matched journal increases the likelihood of successful peer review, while careful

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evaluation helps researchers avoid predatory publishers. Choosing the right journal ensures that research reaches the most appropriate audience and maximizes its academic impact.

6.5 Academic Writing Style

High-quality academic writing is clear, accurate, objective, logically organized, and ethically responsible.

Figure 6.6: Characteristics of Good Academic Writing

6.5.1 Introduction

Scientific research is valuable only when readers can understand it. A well-designed study with strong methodology and meaningful findings may still fail to achieve publication if the manuscript is unclear, poorly organized, or difficult to read. Editors and reviewers expect research papers to communicate ideas in a professional, logical, and objective manner.

Academic writing differs from everyday communication. It is not intended to entertain readers or express personal opinions. Instead, it presents evidence, explains ideas logically, and supports conclusions with reliable sources. Good academic writing does not depend on using complicated vocabulary. In fact, the most effective scientific writing is often simple, direct, and easy to understand.

6.5.2 Characteristics of Academic Writing

Effective academic writing shares several important characteristics. Clarity; Readers should understand the message without unnecessary effort. Researchers should use straightforward language and avoid overly long or confusing sentences. Accuracy; Every statement should be supported by evidence. Statistical results, references, and factual information should be reported correctly. Objectivity; Scientific writing should be based on evidence rather than personal opinion. Instead of writing: AI is obviously the best educational technology. Write: The findings suggest that AI can improve teaching effectiveness when implemented appropriately.

Logical Organization; Ideas should be presented in a logical sequence. Each paragraph should focus on one main idea and connect naturally to the next. Precision; Researchers should choose words carefully. Avoid vague expressions such as: many, very good, huge, a lot. Whenever possible, provide specific information. Good academic writing communicates ideas clearly and professionally.

Table 6.7: Characteristics of Effective Academic Writing

Characteristic	*Description*
Clarity	Easy to understand
Accuracy	Factually correct
Objectivity	Evidence-based

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Characteristic	*Description*
Logical Organization	Well-structured ideas
Precision	Specific and concise language

6.5.3 Writing in an Academic Tone

Academic writing should maintain a professional tone throughout the manuscript.
Researchers should:

- Avoid emotional language.
- Avoid exaggeration.
- Avoid unsupported claims.
- Present balanced arguments.

For example, *Informal***;** This software is amazing. *Academic***;** The software demonstrated satisfactory performance during the evaluation. Professional language improves the credibility of the research.

6.5.4 Writing Clear Sentences

Clear sentences are usually: Short, Direct, Grammatically correct, Focused on one idea. Compare the following examples. *Weak***;** Due to the fact that Artificial Intelligence technologies have become increasingly popular in recent years, it is therefore important to understand numerous factors that may possibly influence their adoption in educational institutions. *Improved;* The increasing use of Artificial Intelligence in education makes it important to understand the factors influencing its adoption. The second sentence communicates the same idea more clearly.

6.5.5 Using Citations Correctly

Academic writing builds upon previous research. Whenever researchers use ideas, theories, methods, or findings developed by others, they should acknowledge the original source. Proper citation:

- Gives credit to previous researchers.
- Demonstrates academic integrity.
- Allows readers to locate original sources.
- Strengthens the credibility of the manuscript.

Researchers should ensure that:

- Every in-text citation appears in the reference list.
- Every reference listed has been cited within the manuscript.

6.5.6 APA 7 Referencing Style

Many journals in education, management, and the social sciences require **APA 7**. Important APA principles include:

- Author–date citation system.
- Alphabetical reference list.
- Consistent formatting.
- Accurate publication details.
- Proper citation of books, journal articles, conference papers, and online resources.

Researchers should carefully follow the journal's required referencing style.

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6.5.7 Avoiding Plagiarism

Plagiarism occurs when researchers present another person's work as their own. Examples include:

- Copying text without citation.
- Paraphrasing too closely without acknowledgment.
- Reusing figures without permission.
- Submitting someone else's work.

Plagiarism is considered a serious violation of academic integrity. Researchers should always cite original sources appropriately. Ethical academic writing requires proper acknowledgment of all sources.

Table 6.8: Examples of Academic Misconduct

Practice	*Acceptable?*
Proper citation of published work	✓
Original paraphrasing with citation	✓
Copying paragraphs without citation	✗
Presenting another person's ideas as your own	✗
Fabricating references	✗

6.5.8 Responsible Use of Artificial Intelligence

Artificial Intelligence tools can assist researchers during the writing process.

Examples include:

- Improving grammar.
- Suggesting clearer wording.
- Organizing ideas.
- Summarizing notes.
- Checking language consistency.

However, AI should not replace the researcher's own scientific thinking. Researchers remain responsible for:

- The accuracy of all information.
- Correct interpretation of findings.
- Proper citation of sources.
- Originality of the manuscript.

AI-generated content should always be reviewed, verified, and revised before submission. Researchers should also follow the AI policies of their university, publisher, or target journal.

6.5.9 Common Writing Mistakes

Beginning researchers frequently make several writing mistakes. These include:

- Long and complicated sentences.
- Repetition of ideas.
- Informal language.
- Unsupported claims.
- Inconsistent terminology.
- Grammatical errors.

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- Poor paragraph organization.
- Incorrect citation formatting.

Careful proofreading helps eliminate many of these problems. Academic writing should be objective, evidence-based, and professionally expressed.

Table 6.9: Weak versus Strong Academic Writing

Weak Writing	*Improved Academic Writing*
AI is fantastic.	AI has demonstrated considerable potential in supporting teaching and learning.
Everyone knows that AI improves education.	Previous studies suggest that AI may improve educational outcomes in appropriate learning environments.
Many people liked the system.	Most participants reported positive perceptions of the system.
This proves the theory.	The findings provide additional support for the proposed theoretical relationship.

6.5.10 Proofreading and Revision

Writing the first draft is only the beginning. Researchers should revise their manuscripts several times. During revision, they should check: Grammar, Spelling, Sentence structure, Consistency, Figures and tables, Citations, References, Formatting. Many successful researchers spend as much time revising as they do writing.

6.5.11 Running Case Study

The researcher completed the first draft of the AI Adoption journal article. During revision, several improvements were made. Long paragraphs were divided into shorter sections. Informal expressions were replaced with objective academic language. Redundant sentences were removed, and citations were checked for accuracy. References were reformatted according to APA 7, and the manuscript was carefully proofread for grammar, spelling, and consistency.

The researcher also used an AI writing assistant to improve sentence clarity. However, every suggestion was reviewed manually, all factual information was verified against the original study, and the final manuscript reflected the researcher's own interpretation and conclusions. As a result, the manuscript became clearer, more professional, and more suitable for journal submission.

Effective academic writing communicates scientific ideas clearly, accurately, and objectively. High-quality manuscripts use logical organization, precise language, appropriate citations, and consistent referencing while maintaining the highest standards of academic integrity. Researchers should avoid plagiarism, revise their work carefully, and use Artificial Intelligence responsibly to improve writing quality without replacing their own critical thinking. Clear writing not only strengthens the manuscript but also increases the likelihood of successful publication in reputable scientific journals.

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6.6 The Manuscript Submission Process

Figure 6.7: The Journal Submission Process

6.6.1 Introduction

After completing a manuscript, many beginning researchers believe that the difficult part of the research journey is over. In reality, submission is another important stage of scientific publishing.

Before a manuscript reaches peer reviewers, it must pass several administrative and editorial checks. Editors examine whether the paper fits the journal's scope, follows the required formatting guidelines, meets ethical standards, and provides all necessary supporting documents. Careful preparation before submission can prevent unnecessary delays and improve the overall efficiency of the publication process.

6.6.2 Preparing the Submission Files

Table 6.10: Common Documents Required for Submission

Document	*Purpose*
Manuscript	Presents the research study
Title Page	Lists the title, authors, and affiliations
Cover Letter	Introduces the manuscript to the editor
Figures and Tables	Support the presentation of results
Supplementary Material	Provides additional information
Ethical Approval	Confirms ethical compliance when required
Conflict of Interest Statement	Declares potential conflicts
Data Availability Statement	Explains how research data can be accessed

Most journals require more than the manuscript itself. Researchers should carefully review the journal's author guidelines and prepare all requested documents before beginning the online submission. Common submission files include:

- The manuscript.
- Title page.
- Cover letter.
- Figures and tables (if submitted separately).
- Supplementary materials (if required).
- Ethical approval documents (when applicable).
- Conflict of interest declaration.
- Data availability statement (if required).

Preparing these files in advance helps ensure a smooth submission process. Many journals request additional documents beyond the manuscript itself

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6.6.3 Preparing the Cover Letter

A cover letter is a short professional letter addressed to the journal editor. Its purpose is to:

- Introduce the manuscript.
- Explain the importance of the research.
- Confirm that the work is original.
- State that the manuscript is not under review elsewhere.
- Thank the editor for considering the submission.

A cover letter should be polite, concise, and professional. It does not need to summarize every detail of the research. Instead, it should briefly explain why the manuscript is suitable for the journal.

6.6.4 Online Submission Systems

Most journals use electronic submission systems. Although the appearance of these systems varies, they generally require similar information. Researchers are usually asked to provide:

- Manuscript title.
- Abstract.
- Keywords.
- Author information.
- Corresponding author details.
- Funding information.
- Ethical declarations.
- Suggested reviewers (if requested).
- Uploaded manuscript and supporting documents.

Researchers should carefully review all information before completing the submission.

6.6.5 Suggested Reviewers

Some journals ask authors to recommend potential reviewers. Suggested reviewers should:

- Be experts in the research area.
- Have no conflict of interest.
- Not belong to the same institution as the authors.
- Be able to provide an objective evaluation.

The editor decides whether to use the suggested reviewers. Authors should never attempt to influence the review process.

6.6.6 Editorial Screening

After submission, the manuscript is first evaluated by the journal editor or editorial office. This stage is called editorial screening. The editor examines whether:

- The manuscript fits the journal's scope.
- The formatting follows the journal guidelines.
- The writing quality is acceptable.
- Ethical requirements have been satisfied.
- The manuscript demonstrates sufficient originality.

If major problems are identified, the manuscript may be returned to the authors before peer review.

6.6.7 Ethical Declarations

Many journals require authors to complete several ethical declarations. These may include:

- Originality statement.

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- Conflict of interest declaration.
- Funding disclosure.
- Human research ethics approval.
- Informed consent statement.
- Data availability statement.

Providing accurate information demonstrates transparency and supports research integrity.

6.6.8 Common Reasons for Initial Rejection

Some manuscripts are rejected before reaching peer reviewers. Common reasons include:

- The manuscript does not fit the journal's scope.
- The paper ignores author guidelines.
- The writing quality is poor.
- Required documents are missing.
- Ethical information is incomplete.
- The manuscript lacks originality.

Careful preparation reduces the likelihood of early rejection. Many submission problems can be avoided through careful preparation.

Table 6.11: Common Submission Mistakes

Mistake	*How to Avoid It*
Ignoring author guidelines	Read the instructions carefully before submission.
Missing required documents	Prepare a complete submission package.
Incorrect formatting	Follow the journal template or formatting guide.
Incomplete author information	Verify names, affiliations, and contact details.
Missing ethical declarations	Complete all required forms honestly.

6.6.9 What Happens After Submission?

After successful submission, the manuscript receives a reference number. Researchers can usually monitor its progress through the journal's online system. Typical stages include:

- Submission received.
- Under editorial review.
- Under peer review.
- Revision requested.
- Accepted.
- Rejected.
- Published online.

The review process may require several weeks or several months, depending on the journal. Researchers should remain patient and avoid submitting the same manuscript to another journal while it is under review.

6.6.10 Best Practices Before Submission

Before clicking the final **Submit** button, researchers should confirm that:

- The manuscript has been proofread.
- References are complete and correctly formatted.
- Figures and tables are properly numbered.
- Author information is accurate.

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- All required documents have been uploaded.
- The manuscript follows the journal's author guidelines.

A final review helps prevent unnecessary delays.

6.6.11 Running Case Study

The researcher completed the AI Adoption manuscript and selected an appropriate international journal. Before submission, the researcher carefully reviewed the journal's author guidelines and prepared all required documents, including the manuscript, title page, cover letter, conflict of interest declaration, and data availability statement.

The manuscript was uploaded through the journal's online submission system. After confirming that all information was correct, the submission was completed successfully. One week later, the editorial office confirmed that the manuscript had passed the initial screening and had been sent to peer reviewers for evaluation. The researcher understood that the next stage would involve receiving reviewer comments and revising the manuscript if necessary.

Submitting a scientific manuscript involves much more than uploading a research paper. Researchers must prepare supporting documents, follow the journal's author guidelines, complete ethical declarations, and provide accurate submission information. A carefully prepared submission improves the efficiency of editorial screening and increases the likelihood that the manuscript will proceed to peer review. Attention to detail at this stage reflects professionalism and supports a successful publication process.

6.7 Understanding Peer Review

Peer review is the process through which experts evaluate a manuscript before publication.

Figure 6.8: The Peer-Review Process

6.7.1 Introduction

Peer review is one of the most important features of scientific publishing. Before research findings become part of the scientific literature, they are usually evaluated by independent experts who assess the quality, originality, methodology, interpretation, and presentation of the manuscript.

Many beginning researchers view peer review as an examination that they must pass. A better way to understand peer review is to see it as a collaborative process designed to improve the quality of scientific research. Reviewers do not simply identify problems. They also provide suggestions that help authors strengthen their manuscripts before publication. For this reason, peer review is widely regarded as an essential mechanism for maintaining the quality and credibility of scientific research.

6.7.2 What Is Peer Review?

Peer review is the evaluation of a scientific manuscript by experts who have knowledge and experience in the same research field. The reviewers examine whether the manuscript:

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- Addresses an important research problem.
- Uses an appropriate research methodology.
- Presents valid results.
- Interprets findings correctly.
- Makes a meaningful contribution to knowledge.
- Meets ethical and academic standards.

After completing their evaluation, reviewers submit recommendations to the journal editor. The editor then decides whether the manuscript should be accepted, revised, or rejected.

6.7.3 Why Is Peer Review Important?

Peer review benefits both researchers and the scientific community. It helps to:

- Improve research quality.
- Identify errors.
- Strengthen arguments.
- Ensure methodological rigor.
- Verify originality.
- Maintain ethical standards.
- Increase confidence in published findings.

Although reviewers may recommend substantial revisions, their suggestions often improve the final manuscript considerably.

6.7.4 Types of Peer Review

Scientific journals use several peer-review models. Single-Blind Review; The reviewers know the identity of the authors, but the authors do not know the identity of the reviewers. This is one of the most common review systems.

Double-Blind Review; Neither the reviewers nor the authors know each other's identities. This approach attempts to reduce potential bias during the review process.

Open Review; Both authors and reviewers know each other's identities. Some journals also publish reviewer comments alongside the final article. Each review model has advantages and challenges, and journals select the approach that best fits their publication policies.

Table 6.12: Types of Peer Review

Review Type	*Reviewer Knows Author?*	*Author Knows Reviewer?*
Single-Blind	✓	✗
Double-Blind	✗	✗
Open Review	✓	✓

6.7.5 What Do Reviewers Evaluate?

Reviewers examine many aspects of a manuscript. Typical evaluation criteria include:

- Originality of the research.
- Importance of the research problem.
- Literature review.
- Theoretical framework.
- Research methodology.
- Data analysis.
- Interpretation of findings.

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- Quality of writing.
- References.
- Ethical compliance.

Reviewers also consider whether the manuscript fits the scope of the journal.

6.7.6 Editorial Decisions

After receiving the reviewer reports, the editor makes a decision. Common editorial decisions include: Accept; The manuscript is suitable for publication with little or no revision. Minor Revision; The manuscript requires small improvements before publication. Examples include correcting grammar, improving explanations, or updating references. Major Revision; The manuscript has potential but requires substantial revision. Examples include improving the discussion, expanding the literature review, clarifying the methodology, or strengthening the interpretation of findings. Most published papers receive at least one revision request.

Reject; The manuscript is not suitable for publication in its current form. Rejection may occur because:

- The research does not fit the journal.
- The methodology is weak.
- The contribution is limited.
- The manuscript requires major redevelopment.

Rejection is common in academic publishing and should be viewed as part of the learning process rather than as personal failure.

Table 6.13: Common Editorial Decisions

Decision	*Meaning*
Accept	Ready for publication
Minor Revision	Small improvements required
Major Revision	Significant revision required
Reject	Manuscript will not be published in its current form

6.7.7 How Long Does Peer Review Take?

The length of the review process varies among journals. Factors influencing review time include:

- Availability of reviewers.
- Complexity of the manuscript.
- Journal workload.
- Number of revision rounds.

Some journals complete reviews within a few weeks, while others may require several months. Researchers should remain patient and avoid sending repeated inquiries unless the review has exceeded the journal's expected timeline.

6.7.8 Responding Professionally

Receiving reviewer comments can be challenging, especially when the manuscript requires major revision. Researchers should remember that reviewer comments are intended to improve the manuscript. A professional response includes:

- Reading every comment carefully.
- Remaining objective.

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- Thanking the reviewers.
- Addressing each comment individually.
- Explaining any disagreements respectfully.

A detailed discussion of reviewer responses is presented in the next section.

6.7.9 Common Misunderstandings

Beginning researchers sometimes have unrealistic expectations. Some believe that:

- A good paper will be accepted immediately.
- Reviewer criticism means the research has failed.
- Editors always follow reviewer recommendations without independent judgment.

In reality:

- Most papers require revision.
- Constructive criticism strengthens research.
- Editors make the final publication decision after considering the reviewer reports and their own evaluation.

Understanding these realities helps researchers approach peer review with confidence.

6.7.10 Running Case Study

After the AI Adoption manuscript passed editorial screening, it was sent to two independent reviewers. The first reviewer praised the originality of the study but recommended expanding the discussion of recent AI adoption research. The second reviewer suggested providing more detail about the questionnaire validation process and improving the explanation of the theoretical contribution. The editor issued a *Major Revision* decision.

Rather than feeling discouraged, the researcher carefully reviewed every comment, revised the manuscript, updated the literature review, clarified the methodology, strengthened the discussion, and prepared a detailed response letter. The revised manuscript was resubmitted and later received a *Minor Revision* decision before final acceptance. The peer-review process substantially improved the quality of the manuscript.

Peer review is a fundamental component of scientific publishing that helps ensure the quality, originality, and credibility of research. Independent experts evaluate manuscripts, provide constructive feedback, and recommend improvements before publication. Most manuscripts require revision, and reviewer comments should be viewed as opportunities to strengthen the research rather than as personal criticism. By understanding the peer-review process and responding professionally, researchers improve both their manuscripts and their skills as scientific authors.

6.8 Responding to Reviewers

A careful and professional response to reviewer comments improves the quality of the manuscript and increases the likelihood of publication.

6.8.1 Introduction

Receiving reviewer comments is a normal part of scientific publishing. Very few manuscripts are accepted without revision. Most authors receive requests to improve their manuscripts before a final publication decision is made.

For many beginning researchers, receiving reviewer comments can be disappointing, especially when the editor requests major revisions. However, experienced researchers understand that revision is a valuable opportunity to improve the quality, clarity, and

scientific contribution of their work. The purpose of reviewer comments is not to criticize the author personally but to strengthen the manuscript. Researchers who respond carefully and professionally often produce much stronger publications than their original submissions.

6.8.2 Understanding Reviewer Comments

Reviewer comments vary in detail and complexity. Some comments may request simple corrections, while others require substantial revision. Common requests include:

- Clarifying the research problem.
- Expanding the literature review.
- Explaining the methodology more clearly.
- Improving data analysis.
- Strengthening the discussion.
- Updating references.
- Correcting language or formatting.

Researchers should read every comment carefully before beginning any revisions.

6.8.3 Reading the Reviews Objectively

The first reaction to reviewer comments is often emotional. Researchers may feel surprised, frustrated, or disappointed. Instead of responding immediately, it is better to:

- Read all comments carefully.
- Allow time to reflect.
- Identify common themes.
- Separate scientific suggestions from editorial corrections.
- Plan the revision process.

A calm and objective approach leads to better revisions.

6.8.4 Preparing the Response Letter

Most journals require a *response letter* (sometimes called a response to reviewers or rebuttal letter). This document explains how each reviewer comment has been addressed. A good response letter should:

- Thank the editor and reviewers.
- Respond to every comment individually.
- Explain the changes made.
- Identify where the changes appear in the revised manuscript.
- Maintain a respectful and professional tone.

Ignoring reviewer comments may reduce the likelihood of acceptance.

Table 6.14: Example Response to a Reviewer

Reviewer Comment	*Author Response*
Please expand the discussion of recent AI adoption studies.	Thank you for this helpful suggestion. We expanded the literature review and discussion by adding several recent studies on AI adoption in higher education. These changes appear on pages 12–14 of the revised manuscript.

6.8.5 Revising the Manuscript

Researchers should revise the manuscript carefully rather than making isolated corrections. For example:

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- Updating the literature review may also require changes in the discussion.
- Revising the methodology may influence the interpretation of results.
- Adding new references may require updates throughout the manuscript.

After making revisions, the manuscript should be reviewed again to ensure consistency.

6.8.6 Responding When You Disagree

Researchers are not required to accept every reviewer suggestion. Occasionally, an author may believe that a recommendation is based on a misunderstanding or is not appropriate for the study. In such situations, researchers should:

- Respond respectfully.
- Explain their reasoning clearly.
- Support their explanation with evidence or references.
- Avoid emotional or defensive language.

For example: *Reviewer Comment***:** Please remove the Trust in AI construct. *Professional Response:* Thank you for your valuable suggestion. We respectfully retained the Trust in AI construct because it is central to the study's theoretical framework and is supported by recent research on AI adoption. To clarify its role, we expanded the theoretical justification in the revised manuscript (pages 6–8). A respectful explanation is more effective than simply rejecting the suggestion.

6.8.7 Tracking Changes

Many journals ask authors to highlight revisions. Common methods include:

- Track Changes in Microsoft Word.
- Highlighted text.
- Different font colors.
- Revised manuscript with line numbers.

Providing visible revisions helps reviewers evaluate the updated manuscript efficiently.

6.8.8 Common Mistakes When Responding

Beginning researchers sometimes make avoidable mistakes. Examples include:

- Ignoring reviewer comments.
- Responding emotionally.
- Providing very short answers.
- Making changes without explaining them.
- Arguing with reviewers.
- Failing to revise related sections of the manuscript.

Professional communication increases the likelihood of a positive editorial decision.

Table 6.15: Weak versus Strong Reviewer Responses

Weak Response	*Strong Response*
Done.	Thank you for the suggestion. We revised the paragraph to clarify the research methodology. The updated text appears on page 9 of the revised manuscript.
We disagree.	Thank you for the valuable comment. We respectfully retained the original approach because it aligns with the theoretical framework. Additional justification has been added on page 7.

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Weak Response	*Strong Response*
No changes were made.	We appreciate the suggestion. After careful consideration, we retained the original text and have provided additional explanation supported by recent references.

6.8.9 Resubmitting the Manuscript

Before resubmitting the revised manuscript, researchers should confirm that:

- Every reviewer comment has been addressed.
- The response letter is complete.
- The revised manuscript is consistent.
- References remain accurate.
- Grammar and formatting have been checked again.

Careful preparation demonstrates professionalism and respect for the reviewers' efforts.

6.8.10 Learning from the Review Process

Even if a manuscript is rejected, the reviewer comments remain valuable. Researchers should:

- Study the comments carefully.
- Improve the manuscript.
- Select another appropriate journal if necessary.
- Continue developing their scientific writing skills.

Every revision contributes to becoming a stronger researcher.

6.8.11 Running Case Study

The AI Adoption manuscript received a *Major Revision* decision. The reviewers requested:

- A stronger explanation of the theoretical contribution.
- Additional discussion of recent AI adoption studies.
- More detail regarding questionnaire validation.
- Minor language improvements.

The researcher prepared a detailed response letter.

Each reviewer comment was copied into the document, followed by a respectful response explaining the revisions made. New references were added, the discussion was expanded, and the methodology section was clarified. The revised manuscript included tracked changes, making it easy for the reviewers to identify all modifications.

Following the second review, the editor requested only minor revisions before accepting the manuscript for publication. The careful revision process significantly improved both the quality of the manuscript and the researcher's academic writing skills.

Responding to reviewers is a collaborative stage of scientific publishing that strengthens both the manuscript and the researcher. Authors should approach reviewer comments objectively, revise their work carefully, and prepare detailed response letters that address every comment respectfully and clearly. Even when disagreements occur, professional communication supported by evidence helps maintain constructive dialogue with reviewers and editors. A thoughtful revision process greatly improves the quality of the manuscript and increases its chances of successful publication.

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6.9 Research Ethics in Publishing

Ethical publishing is built upon honesty, integrity, transparency, responsibility, and trust.

6.9.1 Introduction

Scientific research depends on trust. Researchers trust previous studies when building theoretical frameworks. Editors trust authors to report their findings honestly. Readers trust that published research represents accurate and original scientific work.

Without trust, scientific knowledge cannot develop effectively. Research ethics provide the principles that guide responsible scientific conduct throughout the publication process. These principles ensure that research is conducted honestly, reported accurately, and communicated responsibly.

Ethical publishing is not simply about following journal rules. It reflects the professional responsibility of every researcher to contribute reliable knowledge to the scientific community.

6.9.2 What Is Publication Ethics?

Publication ethics refers to the principles and standards that guide responsible scientific publishing. These principles encourage researchers to:

- Report findings honestly.
- Acknowledge the work of others.
- Protect research participants.
- Avoid misleading readers.
- Respect intellectual property.
- Maintain transparency throughout the research process.

Ethical publishing protects both the credibility of individual researchers and the integrity of science as a whole.

6.9.3 Authorship

Authorship recognizes individuals who made substantial intellectual contributions to the research. Authors normally contribute to activities such as:

- Developing the research idea.
- Designing the study.
- Collecting or analyzing data.
- Interpreting findings.
- Writing or substantially revising the manuscript.
- Approving the final version before submission.

Individuals who provide only administrative support, funding, or routine technical assistance are usually acknowledged separately rather than listed as authors. Researchers should discuss authorship early in the research process to avoid misunderstandings.

6.9.4 Plagiarism

Plagiarism occurs when researchers present another person's words, ideas, figures, or results as their own without proper acknowledgment. Examples include:

- Copying text without citation.
- Using another researcher's ideas without attribution.
- Reproducing figures or tables without permission when required.
- Submitting another person's work under one's own name.

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Plagiarism is considered a serious violation of academic integrity. Researchers should always acknowledge the original source through appropriate citation and referencing.

6.9.5 Self-Plagiarism

Self-plagiarism occurs when researchers reuse substantial portions of their own previously published work without proper acknowledgment or permission. Examples include:

- Republishing the same article in multiple journals.
- Reusing large sections of text without citation.
- Presenting previously published results as new research.

Researchers may build upon earlier work, but they should clearly identify what has been published previously and follow the policies of the target journal.

6.9.6 Data Fabrication and Data Falsification

Scientific findings must be based on genuine research evidence. Data Fabrication; Fabrication involves creating data that were never collected. For example: Inventing questionnaire responses or experimental results. Data Falsification; Falsification involves changing, manipulating, or selectively reporting data to obtain desired results. Examples include:

- Removing valid observations without justification.
- Altering statistical results.
- Modifying figures or tables to support a hypothesis.

Both fabrication and falsification represent serious scientific misconduct.

Table 6.16: Examples of Research Misconduct

Practice	*Ethical?*
Reporting data honestly	✓
Proper citation of sources	✓
Fabricating research data	✗
Altering research findings	✗
Copying text without citation	✗
Duplicate publication	✗

6.9.7 Duplicate Publication

Duplicate publication occurs when essentially the same manuscript is submitted to or published in more than one journal without appropriate disclosure. Researchers should never submit the same manuscript to multiple journals at the same time. Doing so wastes editorial and reviewer resources and may lead to manuscript withdrawal or publication sanctions. If a manuscript is rejected, authors may revise it and submit it to another journal.

6.9.8 Conflict of Interest

A conflict of interest exists when personal, financial, or professional relationships could influence—or appear to influence—the research process or its interpretation. Examples include:

- Financial support from organizations that may benefit from the findings.
- Personal relationships with editors or reviewers.

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- Commercial interests related to the research topic.

Declaring potential conflicts does not necessarily prevent publication. Instead, transparency allows editors and readers to evaluate the research appropriately.

6.9.9 Responsible Use of Artificial Intelligence

Artificial Intelligence has become an important tool for researchers. AI can assist with:

- Grammar improvement.
- Language editing.
- Summarizing information.
- Improving sentence clarity.
- Organizing ideas.

However, AI should not replace the researcher's own scientific judgment. Researchers remain responsible for:

- The originality of the manuscript.
- The accuracy of the information presented.
- Correct interpretation of findings.
- Proper citation of all sources.
- Compliance with journal and institutional AI policies.

Authors should verify AI-generated suggestions carefully and disclose AI use if required by the journal.

6.9.10 Protecting Research Participants

Ethical research also requires respect for participants. Researchers should:

- Obtain informed consent when required.
- Protect participant privacy.
- Maintain confidentiality.
- Store research data securely.
- Follow institutional ethical approval procedures.

Respecting participants strengthens both the quality and credibility of research.

6.9.11 Building an Ethical Research Culture

Research ethics should guide every stage of the research process. Researchers should develop habits of:

- Honest reporting.
- Accurate citation.
- Respectful collaboration.
- Responsible authorship.
- Careful data management.
- Transparent communication.

Ethical behavior protects not only individual researchers but also the reputation of universities, journals, and the wider scientific community.

6.9.12 Running Case Study

While preparing the AI Adoption manuscript for publication, the researcher carefully reviewed the ethical requirements of the selected journal. All references were checked to ensure that previous studies received appropriate acknowledgment. The manuscript was verified for originality using plagiarism-detection software before submission. The researcher confirmed that the study had received institutional ethical approval and that participants had completed the survey voluntarily.

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AI writing tools were used only to improve grammar and sentence clarity. Every suggestion was reviewed manually, and all scientific interpretations remained the responsibility of the researcher. The manuscript also included declarations regarding conflicts of interest, funding, and data availability in accordance with the journal's publication policies. By following these ethical practices, the researcher strengthened the credibility of both the manuscript and the research findings.

6.10 Common Reasons Papers Are Rejected

Manuscripts may be rejected for scientific, methodological, editorial, or ethical reasons.

6.10.1 Introduction

Rejection is a normal part of academic publishing. Even experienced researchers occasionally receive rejection decisions from highly respected journals. A rejected manuscript does not necessarily indicate poor research. In many cases, rejection occurs because the manuscript does not fit the journal, requires additional development, or fails to communicate the research effectively.

Understanding why manuscripts are rejected helps researchers prepare stronger submissions and respond more effectively to editorial feedback. Rather than viewing rejection as failure, researchers should regard it as an opportunity to improve their work and continue developing as scientific authors.

6.10.2 Submitting to the Wrong Journal

One of the most common reasons for immediate rejection is that the manuscript does not match the journal's aims and scope. Editors first determine whether the research is relevant to the journal's readership. For example, a manuscript on AI adoption in higher education is unlikely to be considered by a journal specializing exclusively in environmental engineering.
Researchers should carefully review:

- The journal's aims and scope.
- Previously published articles.
- Target audience.
- Submission guidelines.

Selecting an appropriate journal significantly increases the likelihood of successful review.

6.10.3 Limited Originality

Scientific journals seek research that contributes new knowledge. A manuscript may be rejected if it:

- Repeats previous studies without meaningful extension.
- Addresses a well-established problem without new insight.
- Makes only a minor contribution to existing knowledge.

Researchers should clearly explain:

- What gap the study addresses.
- How it differs from previous research.
- Why the findings are important.

Novelty does not always require a completely new theory. It may involve a new context, methodology, population, dataset, or theoretical integration.

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6.10.4 Weak Research Methodology

A strong research question cannot compensate for weak methodology. Reviewers carefully evaluate whether:

- The research design is appropriate.
- The sampling strategy is justified.
- Measurement instruments are reliable and valid.
- Statistical analyses are suitable.
- Ethical procedures have been followed.

Methodological weaknesses reduce confidence in the findings and frequently lead to rejection.

Table 6.17: Examples of Methodological Weaknesses

Weakness	*Possible Consequence*
Inadequate sample size	Reduced confidence in results
Unvalidated questionnaire	Questionable measurement quality
Inappropriate statistical analysis	Unreliable conclusions
Poorly described methodology	Limited reproducibility
Missing ethical approval	Ethical concerns

6.10.5 Poor Organization and Writing

Editors and reviewers evaluate not only scientific quality but also how clearly the research is presented. Common writing problems include:

- Unclear objectives.
- Weak organization.
- Long and repetitive sentences.
- Grammatical errors.
- Inconsistent terminology.
- Poor figure and table presentation.

Good writing helps reviewers understand the research and evaluate its contribution fairly.

6.10.6 Weak Discussion and Conclusions

Many manuscripts report statistical results successfully but fail to explain their significance. Common problems include:

- Repeating the Results section.
- Ignoring theory.
- Failing to compare findings with previous research.
- Weak practical implications.
- Unsupported conclusions.

The Discussion should explain *why the findings matter*, not simply repeat numerical results.

6.10.7 Failure to Follow Journal Guidelines

Every journal provides detailed author instructions. Ignoring these requirements may result in immediate editorial rejection. Common problems include:

- Incorrect formatting.
- Exceeding word limits.
- Incorrect reference style.

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- Missing declarations.
- Improper figure formatting.

Researchers should treat author guidelines as an essential part of manuscript preparation.

6.10.8 Ethical Problems

Editors take publication ethics very seriously. Ethical concerns that may lead to rejection include:

- Plagiarism.
- Duplicate submission.
- Duplicate publication.
- Data fabrication.
- Data falsification.
- Undisclosed conflicts of interest.
- Inappropriate authorship practices.

Maintaining high ethical standards protects both researchers and the scientific record.

6.10.9 Inadequate Literature Review

A weak literature review reduces the credibility of the manuscript. Common problems include:

- Outdated references.
- Missing influential studies.
- Poor theoretical foundation.
- Excessive description without critical analysis.

Researchers should include recent, relevant, and high-quality references that support the research problem and theoretical framework.

6.10.10 Responding Poorly to Reviewers

Even after receiving revision requests, some manuscripts are rejected because authors respond inappropriately. Examples include:

- Ignoring reviewer comments.
- Providing incomplete responses.
- Using defensive language.
- Making revisions without explanation.

Professional communication improves the relationship between authors, reviewers, and editors.

Table 6.18: Common Reasons for Rejection and How to Avoid Them

Reason for Rejection	*Prevention Strategy*
Wrong journal	Match the manuscript to the journal's scope
Limited originality	Clearly explain the research contribution
Weak methodology	Apply appropriate research methods
Poor writing	Revise, proofread, and seek feedback
Weak discussion	Interpret findings using theory and literature
Formatting problems	Follow author guidelines carefully
Ethical concerns	Maintain honesty and transparency
Poor reviewer responses	Respond respectfully and completely

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6.10.11 Learning from Rejection

Rejection is part of every researcher's academic journey. Many highly cited papers were initially rejected before being published successfully elsewhere. When a manuscript is rejected, researchers should:

- Read the editor's decision carefully.
- Study reviewer comments objectively.
- Improve the manuscript.
- Select another appropriate journal if necessary.
- Continue developing their research and writing skills.

Each rejection provides valuable experience that contributes to future success.

Running Case Study

The AI Adoption manuscript received a *Major Revision* decision from the first journal. The reviewers praised the importance of the research but identified several areas requiring improvement, including a stronger explanation of the theoretical contribution, additional recent references, and a more comprehensive discussion of practical implications.

The researcher carefully revised the manuscript by expanding the literature review, strengthening the discussion, improving the writing style, and addressing every reviewer comment in a detailed response letter. Following resubmission, the manuscript was accepted for publication. This experience demonstrated that reviewer feedback and revision are normal parts of the publication process and often lead to significantly stronger research articles.

6.11 Chapter Summary

Chapter 6 completed the research journey by explaining how to transform a completed research project into a publishable scientific manuscript. While the previous chapters focused on conducting theory-driven research using SmartPLS, this chapter emphasized that research achieves its greatest impact only when it is communicated effectively through academic publication.

The chapter introduced the structure of a scientific journal article and provided practical guidance on writing each section, including the title, abstract, introduction, methodology, results, discussion, conclusion, and references. Readers also learned how to select an appropriate journal by considering its scope, quality, and indexing, and how to prepare a manuscript that meets journal submission requirements.

The chapter further explained the publication process, from online submission and editorial screening to peer review, revision, and editorial decisions. It emphasized the importance of responding professionally to reviewer comments and viewing revisions as opportunities to improve manuscript quality. In addition, the chapter highlighted the principles of research ethics and publication integrity, including responsible authorship, proper citation, plagiarism avoidance, and the ethical use of Artificial Intelligence.

Throughout the chapter, the running case study on Artificial Intelligence Adoption in Higher Education demonstrated how a completed research project can be prepared, submitted, revised, and published in an international journal. By the end of the chapter, readers had developed a clear understanding of the complete publication process and the skills required to communicate research effectively, ethically, and professionally, enabling their work to contribute to scientific knowledge and professional practice.

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6.12 Running Case Study: Completing the AI Adoption Research Project: From Research to Publication

*Purpose of the Case Study:*Throughout this book, we have followed the development of a theory-driven research project on *Artificial Intelligence Adoption in Higher Education*. The study progressed from identifying the research problem and developing the conceptual framework to designing the measurement instrument, analyzing the data using SmartPLS, and interpreting the findings. In this final chapter, the researcher prepares the completed study for publication in an international scientific journal.

*Step 1: Preparing the Manuscript***:** The thesis is condensed into a journal article following the IMRAD structure. The literature review, methodology, results, and discussion are revised to meet the journal's word limit while preserving the study's main contribution.

*Step 2: Selecting the Journal***:** The researcher selects a Scopus-indexed journal whose scope aligns with educational technology, higher education, and quantitative research using Structural Equation Modeling.

*Step 3: Submission and Peer Review***:** The manuscript and supporting documents are submitted through the journal's online system. After editorial screening, the paper proceeds to peer review, where reviewers request revisions to strengthen the literature review, methodology, and discussion.

*Step 4: Revision and Acceptance***:** The researcher addresses all reviewer comments, revises the manuscript, and submits a detailed response letter. After the revisions are approved, the manuscript is accepted for publication.

6.13 Analytical Review & Critical Inquiry

Before moving forward, pause to evaluate the core assumptions and structural relationships introduced in this chapter

📖 Why should researchers avoid selecting a journal based only on its Impact Factor?

📖 Explain why a manuscript with excellent research may still be rejected.

📖 Should authors always accept every reviewer suggestion? Justify your answer.

📖 Why is ethical publishing essential for maintaining public trust in scientific research?

📖 Explain how Artificial Intelligence can improve academic writing while preserving research integrity

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Appendix A : Quick Reference Guides

This appendix provides concise reference guides that summarize the most important concepts, evaluation criteria, and reporting recommendations presented throughout the book. These guides are intended to serve as a practical reference during the design, analysis, interpretation, and reporting of theory-driven quantitative research using SmartPLS.

A.1 Theory-Driven Research Workflow

Research Problem → Literature Review → Research Gap → Scientific Theory → Conceptual Framework → Research Hypotheses → Measurement Model → Data Collection → SmartPLS Analysis → Interpretation → Scientific Publication

A.2 Measurement Model Evaluation (Reflective Constructs)

Criterion	*Recommended Value*
Indicator Loading	≥ 0.708
Cronbach's Alpha	≥ 0.70
Composite Reliability (CR)	0.70–0.95
Average Variance Extracted (AVE)	≥ 0.50
HTMT	< 0.85 (preferred) or < 0.90
Collinearity (VIF)	< 3.3 (preferred) or < 5.0

A.3 Structural Model Evaluation

Criterion	*Purpose*
Collinearity (VIF)	Detect multicollinearity
Path Coefficients (β)	Test hypothesized relationships
Bootstrapping	Assess statistical significance
Coefficient of Determination (R^2)	Explanatory power
Effect Size (f^2)	Contribution of each predictor
Predictive Relevance (Q^2)	Out-of-sample predictive capability
PLSpredict	Model prediction assessment

A.4 Manuscript Structure (IMRAD)

Title → Abstract → Keywords → Introduction → Literature Review → Methodology → Results → Discussion → Conclusion → References

A.5 Journal Submission Workflow

Completed Manuscript → Journal Selection → Author Guidelines → Online Submission → Editorial Screening → Peer Review → Revision → Acceptance → Publication

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A.6 Common SmartPLS Reporting Elements

- Research objective
- Sample characteristics
- Measurement model assessment
- Structural model assessment
- Hypothesis testing
- Theoretical contribution
- Practical implications
- Research limitations
- Future research
- Conclusion

A.7 Common SmartPLS Abbreviations

Abbreviation	*Meaning*
AI	Artificial Intelligence
AVE	Average Variance Extracted
CR	Composite Reliability
HTMT	Heterotrait–Monotrait Ratio
PLS-SEM	Partial Least Squares Structural Equation Modeling
Q^2	Predictive Relevance
R^2	Coefficient of Determination
SEM	Structural Equation Modeling
SRMR	Standardized Root Mean Square Residual
VIF	Variance Inflation Factor

Appendix B : Common CB-SEM (AMOS) Threshold Values (Add-On)

This appendix summarizes the most commonly reported evaluation criteria for Covariance-Based Structural Equation Modeling (CB-SEM) using IBM SPSS AMOS. These guidelines provide a quick reference for assessing measurement quality, model fit, reliability, and validity. Researchers should interpret these values in conjunction with theoretical justification and current methodological recommendations.

B.1 Model Fit Indices

Fit Index	*Recommended Value*	*Interpretation*
χ^2/df (CMIN/df)	< 3.0 (acceptable), < 2.0 (good)	Overall model fit
RMSEA	< 0.08 (acceptable), < 0.06 (good)	Approximate model fit
SRMR	< 0.08	Standardized residuals
CFI	≥ 0.90 (acceptable), ≥ 0.95 (excellent)	Comparative fit
TLI	≥ 0.90 (acceptable), ≥ 0.95 (excellent)	Incremental fit
IFI	≥ 0.90	Incremental fit
GFI	≥ 0.90	Absolute fit

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Fit Index	*Recommended Value*	*Interpretation*
AGFI	≥ 0.80–0.90	Adjusted fit
NFI	≥ 0.90	Normed fit

B.2 Reliability

Criterion	*Recommended Value*
Cronbach's Alpha	≥ 0.70
Composite Reliability (CR)	≥ 0.70

B.3 Convergent Validity

Criterion	*Recommended Value*
Standardized Factor Loading	≥ 0.70
Average Variance Extracted (AVE)	≥ 0.50

B.4 Discriminant Validity

Criterion	*Recommended Value*
Square Root of AVE	Greater than inter-construct correlations
HTMT (optional)	< 0.85 (preferred)

B.5 Multicollinearity

Criterion	*Recommended Value*
Variance Inflation Factor (VIF)	< 5.0

B.6 Structural Model

Criterion	*Recommended Value*
Standardized Regression Weight	Significant (p < .05)
Critical Ratio (CR)	±1.96 (95% confidence)
p-value	< .05

B.7 Common Reporting Sequence

1. Data screening
2. Confirmatory Factor Analysis (CFA)
3. Model fit evaluation
4. Reliability assessment
5. Convergent validity
6. Discriminant validity
7. Structural model evaluation
8. Hypothesis testing

Note: The threshold values presented in this appendix represent commonly accepted guidelines rather than absolute decision rules. Model evaluation should always consider theoretical justification, research design, sample characteristics, and the overall quality of the measurement and structural models.

Appendix C: Choosing Between SmartPLS and AMOS

Purpose: This appendix provides a practical comparison between Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS and Covariance-Based Structural Equation Modeling (CB-SEM) using AMOS. Understanding the strengths and limitations of each approach helps researchers select the method most appropriate for their research objectives.

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SmartPLS versus AMOS

Aspect	*SmartPLS (PLS-SEM)*	*AMOS (CB-SEM)*
Primary Objective	Prediction and theory development	Theory testing and confirmation
Research Focus	Exploratory and predictive	Confirmatory
Statistical Approach	Variance-based	Covariance-based
Sample Size	Small to large	Moderate to large
Data Distribution	No normality assumption	Multivariate normality preferred
Model Complexity	Handles complex models well	Better for simpler, theory-driven models
Formative Constructs	Fully supported	Limited support
Reflective Constructs	Supported	Supported
Higher-Order Constructs	Easy to model	More complex
Prediction (PLSpredict)	Available	Not available
Software	SmartPLS	IBM SPSS AMOS

When Should You Use SmartPLS?

Use SmartPLS when your study aims to:

- Develop or extend theory.
- Predict key outcome variables.
- Analyze complex research models.
- Include formative constructs.
- Work with small or non-normal datasets.
- Emphasize prediction and practical application.

When Should You Use AMOS?

Use AMOS when your study aims to:

- Confirm an established theory.
- Evaluate overall model fit.
- Test a well-developed theoretical model.
- Work with large samples that satisfy normality assumptions.
- Focus on covariance-based model validation.

Final Recommendation

Neither SmartPLS nor AMOS is universally superior. The appropriate choice depends on the research objective, theoretical maturity, model characteristics, sample size, and data properties. Researchers should select the method that best aligns with their research questions rather than choosing software based on familiarity or popularity.

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Scientific research is not defined by the software you use but by the questions you ask, the theories you build, and the knowledge you contribute. SmartPLS is a powerful analytical tool, but it is only one part of the research journey. The true value of research lies in curiosity, critical thinking, methodological rigor, and a commitment to advancing scientific knowledge. I hope this book serves not only as a guide to quantitative research but also as an encouragement to pursue meaningful, ethical, and impactful scholarship.

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